User Manual

RELIANCE ELECTRIC

LiquiFlo 2.0 AC Drive

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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This manual contains new and updated information.

New and Updated Information

This table contains the major changes made to this revision.

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Added Motor Overload Protection specification	234

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Introduction

This manual is intended for qualified electrical and plumbing personnel familiar with installing, programming, and maintaining AC drives.

This manual contains information on:

- Installing and wiring the LiquiFlo 2.0 AC drive
- Programming the drive
- Troubleshooting the drive

	ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.
	ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait 5 minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.
	ATTENTION: The drive can operate at and maintain zero speed. You are responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.
	ATTENTION: Do not install modification kits with power applied to the drive. Disconnect and lock out incoming power before attempting such installation or removal. Failure to observe this precaution could result in severe bodily injury or loss of life.
	ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

ATTENTION: The drive contains ESD- (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing the drive. Erratic machine operation and damage to, or destruction of, equipment can result if this procedure is not followed. Failure to observe this precaution can result in bodily injury.

ATTENTION: You are responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Firmware Versions

There are two frame types for LiquiFlo 2.0 drives: Frame 3 and Frame 4. See Chapter 2 for a description of the physical layout, components, and ratings for each frame type.

Each drive contains two sections: the **inverter** section and the **rectifier** section. Each section contains its own firmware.

- Firmware for Frame 3 drives are version 1.*xx* series
- Firmware for Frame 4 drives are version 2.*xx* series

The current drive firmware versions are listed in Table 1.

Table 1 - Firmware Versions

Release Date	Firmware Type	Current Version
May 2011	Frame 3 inverter application firmware	1.12
May 2011	Frame 3 rectifier application firmware	1.14
June 2011	Frame 4 inverter application firmware	2.12
June 2011	Frame 4 rectifier application firmware	2.12

See Determining the Product Version on page 227 for instructions on determining the firmware version currently installed in a drive.

Manual Conventions

Parameter names: In most instances, parameter names are shown as the parameter name followed by the parameter number. The parameter name is preceded by inverter or rectifier for reference.

For example: inverter PI Control (125).

Getting Assistance from Rockwell Automation

If you have any questions or problems with the products described in this instruction manual, contact your local Rockwell Automation sales office. For technical assistance, call 1-888-926-6786, Option 1.

Also, see Rockwell Automation Support on the back cover of this user manual for technical support contact information.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
VS Utilities Getting Results Manual, publication D2-3488	Provides information explaining the uses and interface of VS Utilities, and information to help you complete basic tasks such as installing the software and starting the application, and finding instructions to complete more sophisticated tasks using the online help.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Rockwell Automation sales representative.

Notes:

About the Drive

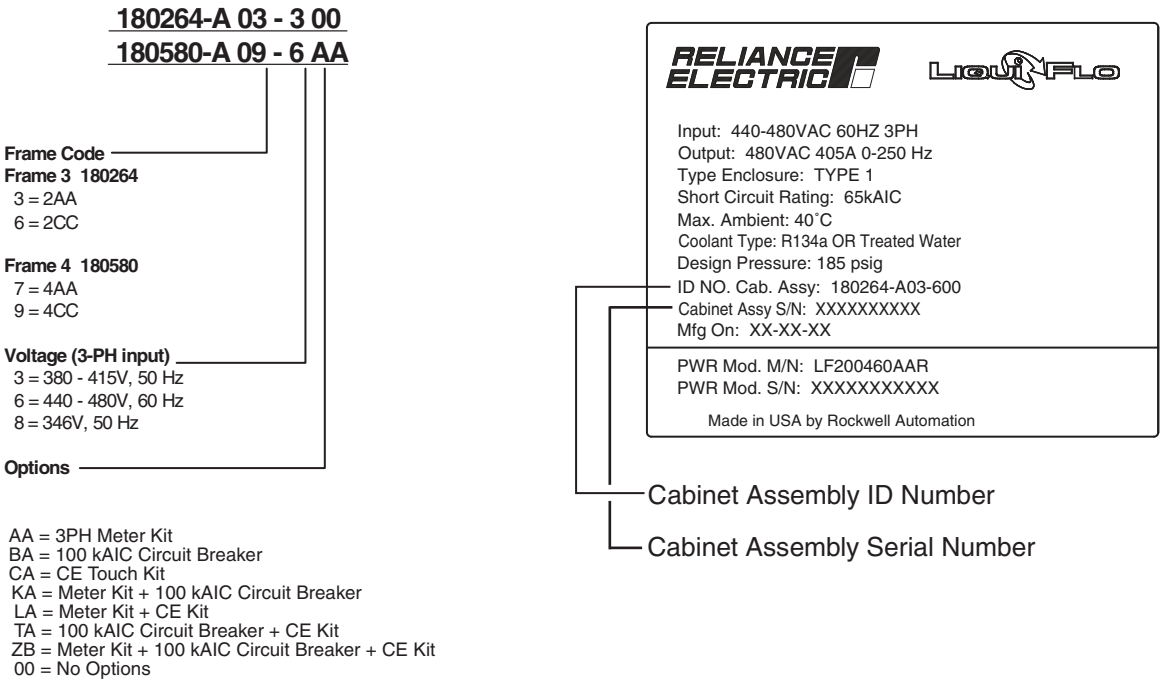
This chapter describes how to identify the drive assembly, the power module, and shows the major drive components.

The LiquiFlo 2.0 AC drive is a pulse-width-modulated (PWM) liquid-cooled drive that provides vector and general purpose regulation for a wide range of applications.

Identifying the Drive by Cabinet Assembly ID Number

Each LiquiFlo 2.0 AC drive is identified by its assembly number or order number (see Figure 1). These numbers appear on the shipping label and on the nameplate of the drive.

Figure 1 - Identifying the Drive by Cabinet Assembly ID Number


180264-A 03 - 3 00
180580-A 09 - 6 AA
Frame Code
Frame 3 180264
3 = 2AA
6 = 2CC
Frame 4 180580
7 = 4AA
9 = 4CC
Voltage (3-PH input)
3 = 380 - 415V, 50 Hz
6 = 440 - 480V, 60 Hz
8 = 346V, 50 Hz
Options
AA = 3PH Meter Kit
BA = 100 kAIC Circuit Breaker
CA = CE Touch Kit
KA = Meter Kit + 100 kAIC Circuit Breaker
LA = Meter Kit + CE Kit
TA = 100 kAIC Circuit Breaker + CE Kit
ZB = Meter Kit + 100 kAIC Circuit Breaker + CE Kit
00 = No Options
RELIANCE ELECTRIC
LiquiFlo
Input: 440-480VAC 60HZ 3PH
Output: 480VAC 405A 0-250 Hz
Type Enclosure: TYPE 1
Short Circuit Rating: 65kAIC
Max. Ambient: 40˚C
Coolant Type: R134a OR Treated Water
Design Pressure: 185 psig
ID NO. Cab. Assy: 180264-A03-600
Cabinet Assy S/N: XXXXXXXXXX
Mfg On: XX-XX-XX
PWR Mod. M/N: LF200460AAR
PWR Mod. S/N: XXXXXXXXXXX
Made in USA by Rockwell Automation
Cabinet Assembly ID Number
Cabinet Assembly Serial Number

LiquiFlo 2.0 Drive Component Locations

LiquiFlo 2.0 AC drives include a drive section and a power module section. The components are listed and illustrated below.

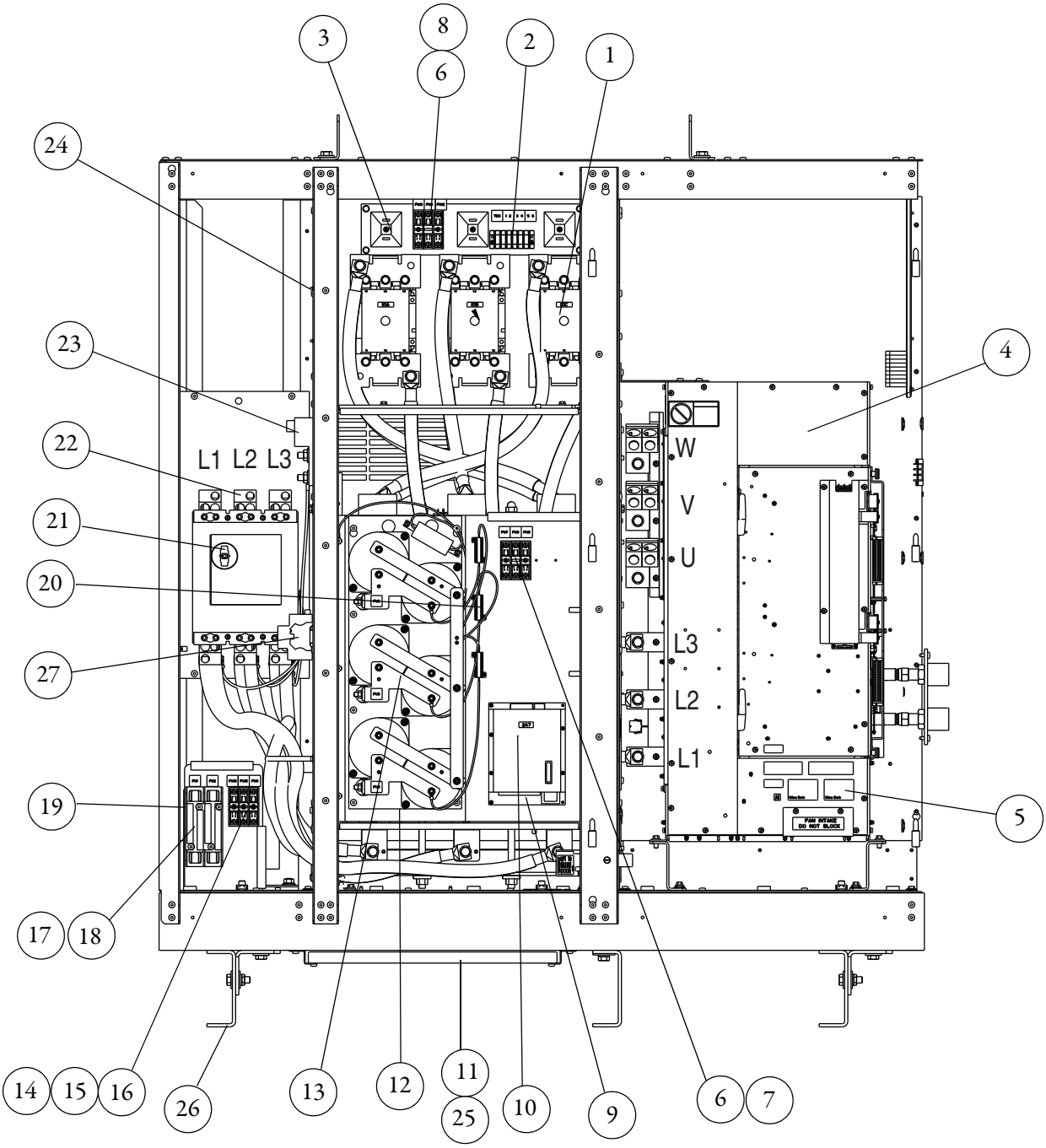
Drive Components Locations (Frame 3)

Frame 3 Units 180264-A0x

The drive section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 2. Replacement parts are listed in Chapter 10.

1. AC Contactor (3) with Surge Suppressor
2. Terminal Block, 6-position
3. Precharge Resistors (3)
4. Power Module Assembly
5. Power Module Nameplate
6. Fuse Block, 30 A, 600V, Class CC, 3-Line
7. Fuse, Class CC, 600V, 1 A
8. Fuse, Class CC, 600V, 20 A
9. Line Sync. PC Board Assembly
10. Line Sync. Board Cover
11. 115V Fan, 6 in. diameter (2)
12. Capacitor Guard Panel (not shown)
13. Capacitor Bank Assembly
14. Fuse Block, 30 A, 600V, Class CC
15. Fuse, Class CC, 600V, 5 A
16. Fuse, Class CC, 600V, 25 A
17. Fuse Holder, 600V, 30 A
18. Fuse, Class RK5, 600V, 15 A
19. Transformer, 5 kVA
20. Resistor, 100 kOhm, 50 W
21. Operating Mechanism, Complete Kit
22. Main Input Circuit Breaker
23. Ground Lug, 2-600 MCM
24. 115V Fan, 5 in., sq.
25. Air Filter
26. Floor Mounting Kit (3)
27. Surge Suppressor

Figure 2 - Drive Components (Frame 3)



Power Module Components Locations (Frame 3)

Frame 3 Units LF200460AAR and LF200608CCR

The power module section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 3 and Figure 4. Replacement parts are listed in Chapter 10.

1. Wire Harness Assembly, Power Supply, Logic (2)
2. Current Feedback Device, 1000 A (6)
3. Terminal Block, 2-Position
4. 80 W Power Supply Assembly (2)
5. Cable Assembly, 40-pin, 0.050 in Pitch, Flex Film (2)
6. Cable Assembly, 30-pin, 0.050 in Pitch, Flex Film (2)
7. Wire Harness Assembly, Power Supply, Upper Gate (2)
8. Inverter Power Interface Assembly
9. Wire Harness Assembly, Power Supply, Lower Gate (2)
10. Insulation Sheet (2)
11. Communications Interface Assembly
12. Rectifier Power Interface Assembly
13. Wire Harness Assembly, Gate Driver
14. Wire Harness Assembly, Current Feedback Device
15. Wire Harness Assembly, Line Sync.
16. Wire Harness Assembly, DC Bus Bleeder Resistors
17. Cable Assembly, 20-pin, 0.050 in Pitch, Flex Film (optional)
18. Communications Assembly (optional)
19. Internal Fan
20. Connector, Terminal Block, 32-pin
21. AC Line I/O Assembly
22. Rectifier Control Assembly
23. Inverter Control Assembly
24. Standard I/O Assembly
25. Wire Harness Assembly, Control Sync.

Figure 3 - Power Module Component Locations - Door Open (Frame 3)

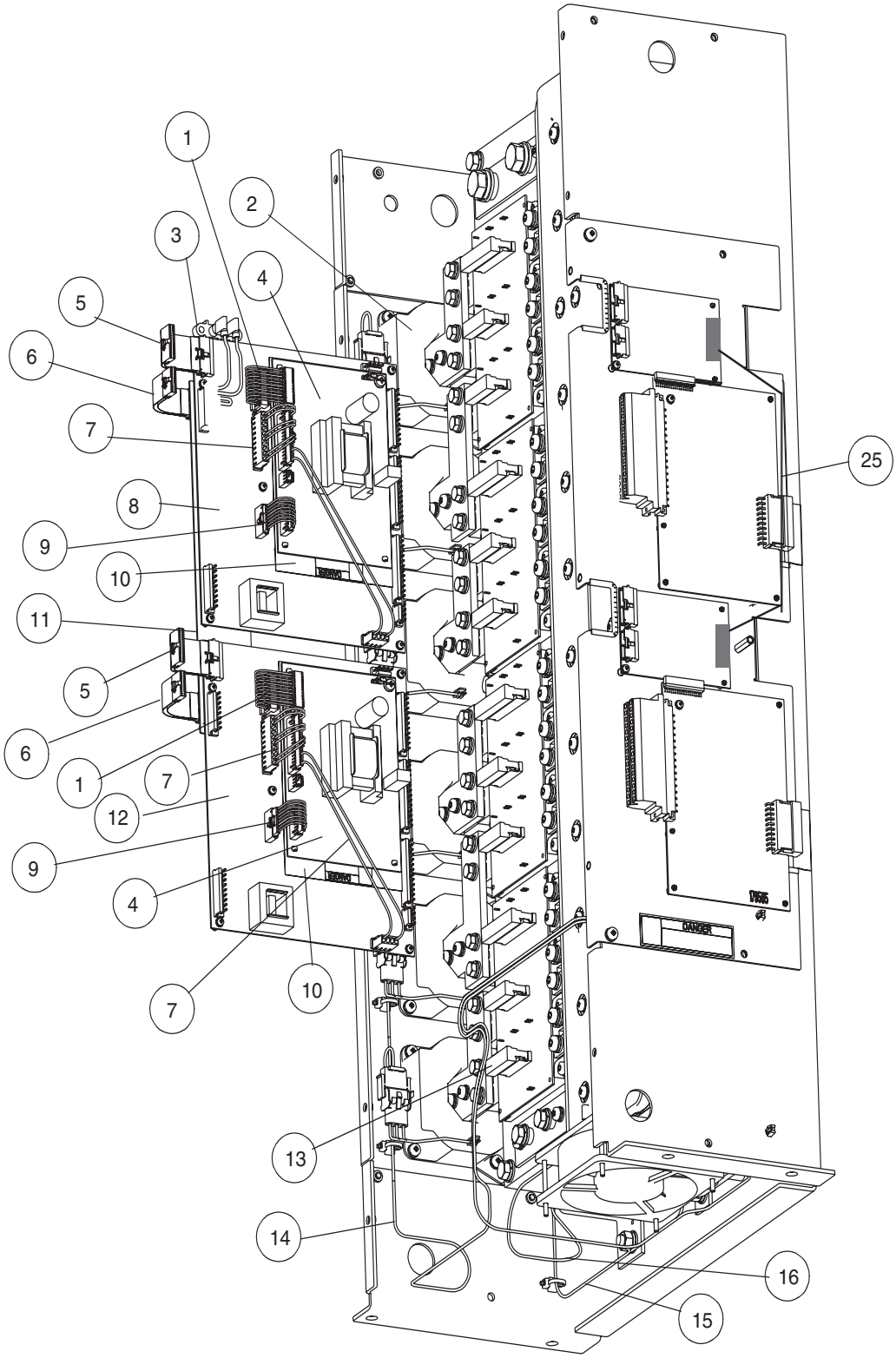
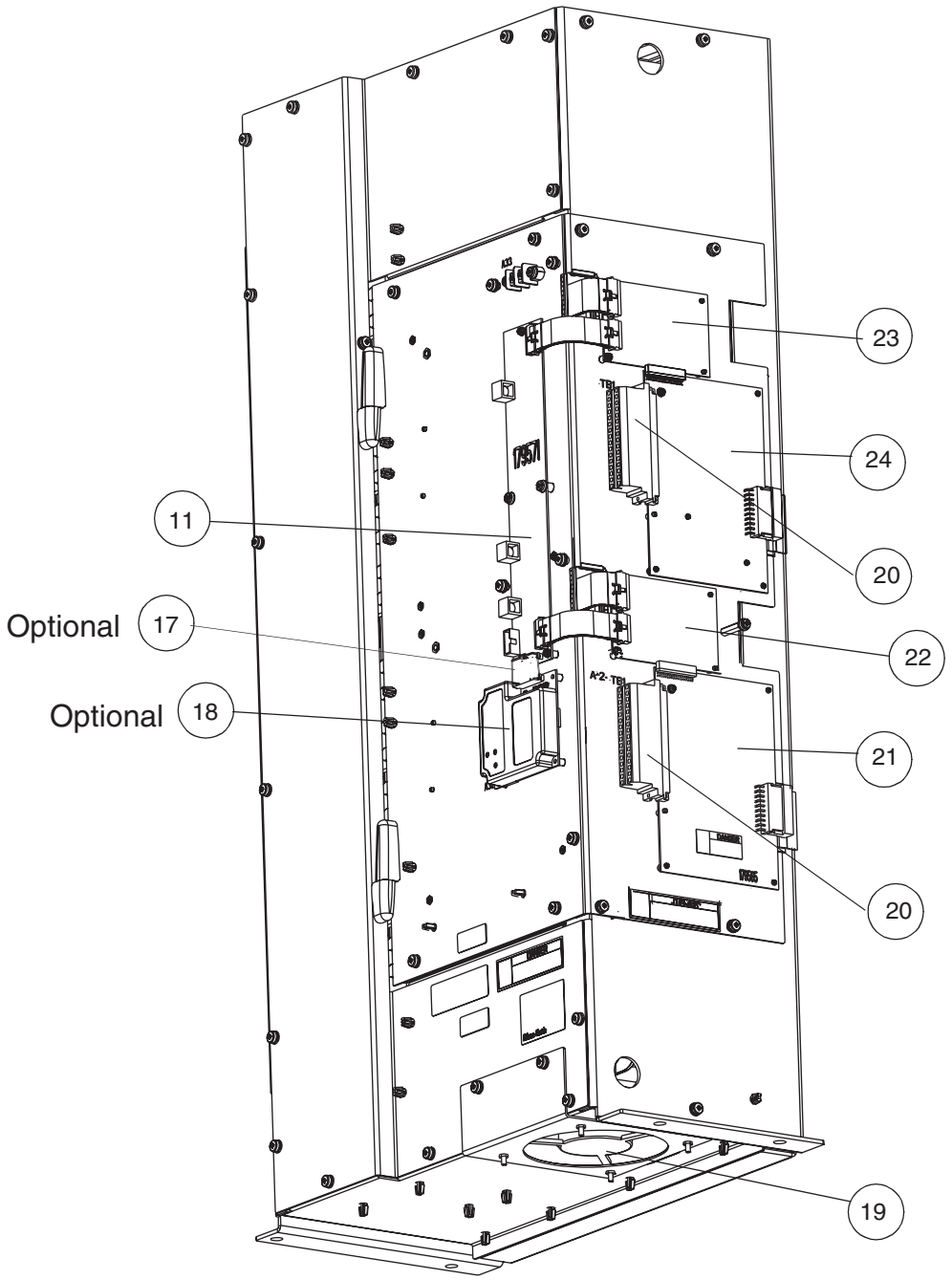


Figure 4 - Power Module Component Locations - Door Closed (Frame 3)



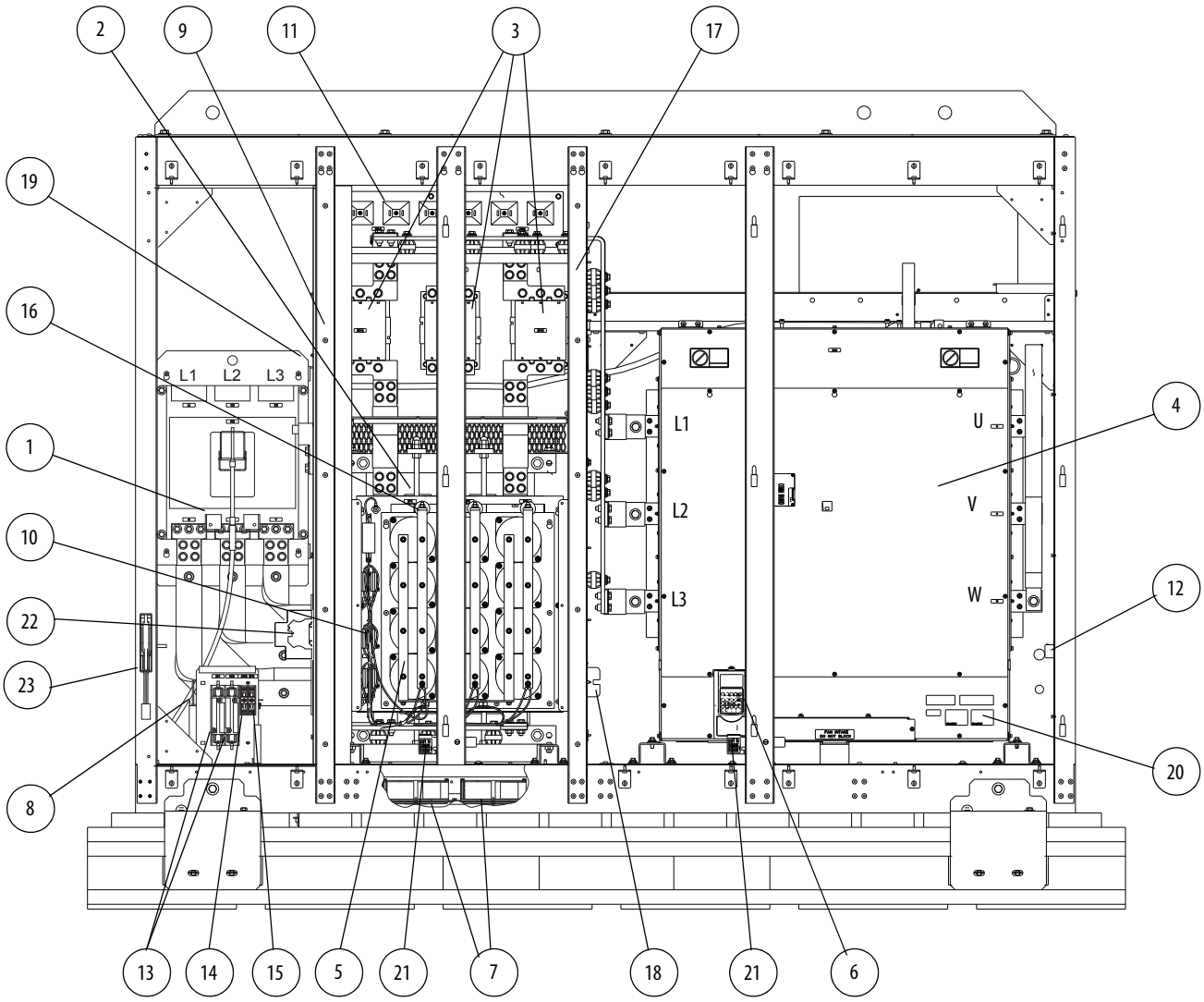
Drive Components Locations (Frame 4)

Frame 4 Units 180580-A07 and 180580-A09

The drive section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 5. Replacement parts are listed in Chapter 10.

1. Circuit Breaker, 600V
2. Inductor
3. AC Contactor
4. Power Module Assembly
5. Input Filter Capacitor Assembly
6. OIM
7. Fans, 115V AC, Inductor (4)
8. Transformer, 5 kVA
9. Fan, 115V AC, Contactor
10. Resistors, 100 kOhms, 50 W
11. Precharge Resistors
12. Relay, Oil Pump & Control Power Terminals
13. Fuse, Class RK-5, 600V, 10 A (2)
14. Fuse, Class CC, 600V, 25 A (1)
15. Fuse, Class CC, 600V, 10 A (1)
16. Fuse, Class T, 600V, 300 A (3)
17. Fuse, Class CC, 600V, 20 A (3)
18. Fuse, Class CC, 600V, 1 A (3)
19. Ground Lug, 2-600 MCM
20. Nameplate, Power Module
21. Door Inter-lock (2)
22. Surge Suppressor
23. Circuit Breaker Operating Mechanism

Figure 5 - Drive Components (Frame 4)



Power Module Components Locations (Frame 4)

Frame 4 Units LF200900CCR and LF201215CCR

The power module section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 6 and Figure 7. Replacement parts are listed in Chapter 10.

1. Combined Power PCB Assembly, 900 A, or
   Combined Power PCB Assembly, 1215 A
2. Wire Harness Assembly, Gate Driver
3. Internal Fan, 24V DC
4. Internal Fan, 24V DC
5. Wire Harness Assembly, Internal Fan
6. Wire Harness Assembly, DC Power
7. Wire Harness Assembly, DC Bus Resistors
8. Current Feedback Device, 2000 A
9. Wire Harness Assembly, Current Feedback Device, Rectifier Side
10. Wire Harness Assembly, Current Feedback Device, Inverter Side
11. Wire Harness Assembly, RTD, Recitifier Side
12. Wire Harness Assembly, RTD, Inverter Side
13. Cable Assembly, 40-Pin
14. Combined Control PCB Assembly
15. Combined I/O PCB Assembly
16. RS-485 Communications Assembly (optional)
17. Cable Assembly, 20-Pin (optional)
18. Cable, Mini DIN, 8 Pos., Male/Male, 1 m (3.2 ft)

Figure 6 - Power Module Component Locations - I/O and Control Panel Removed (Frame 4)

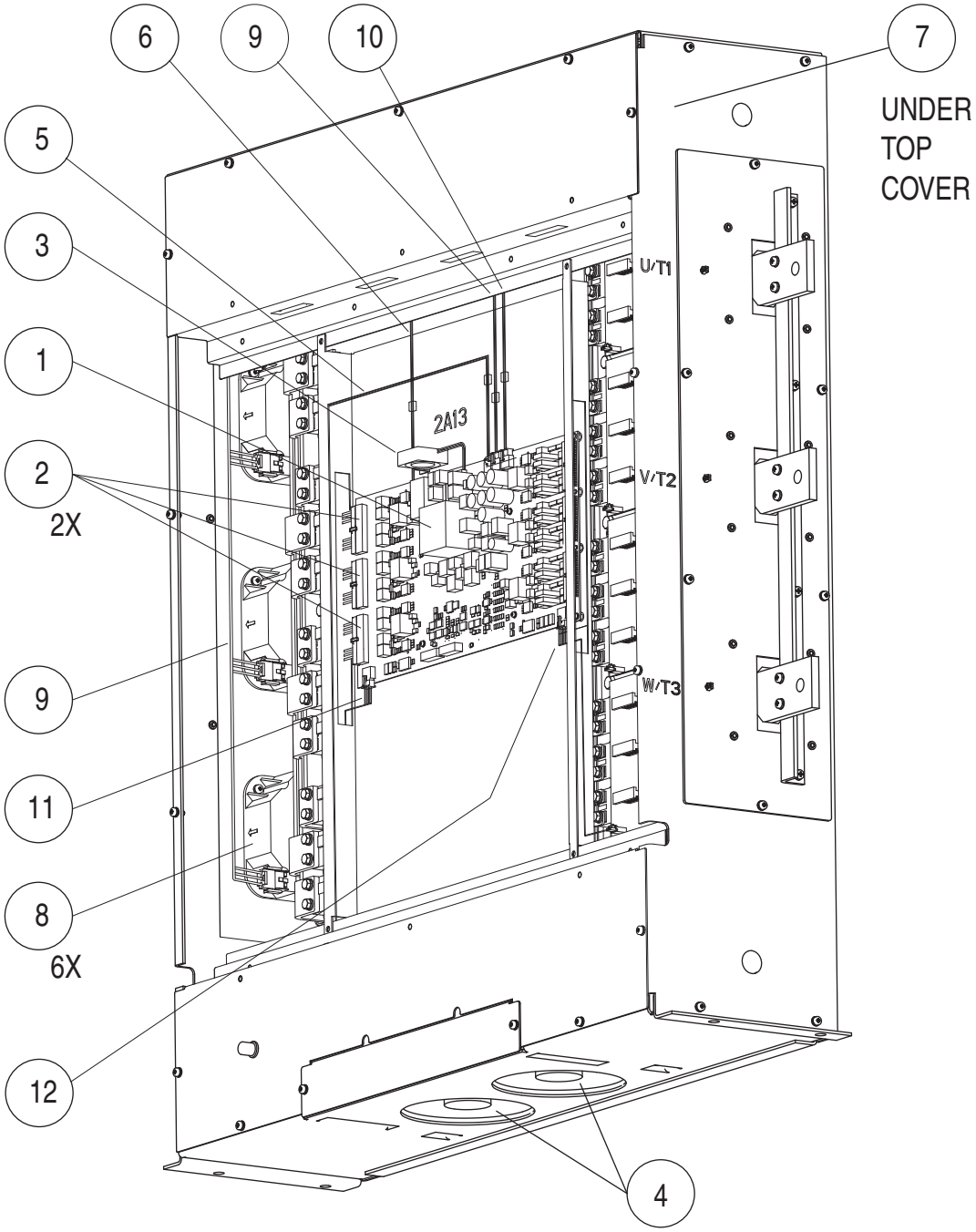
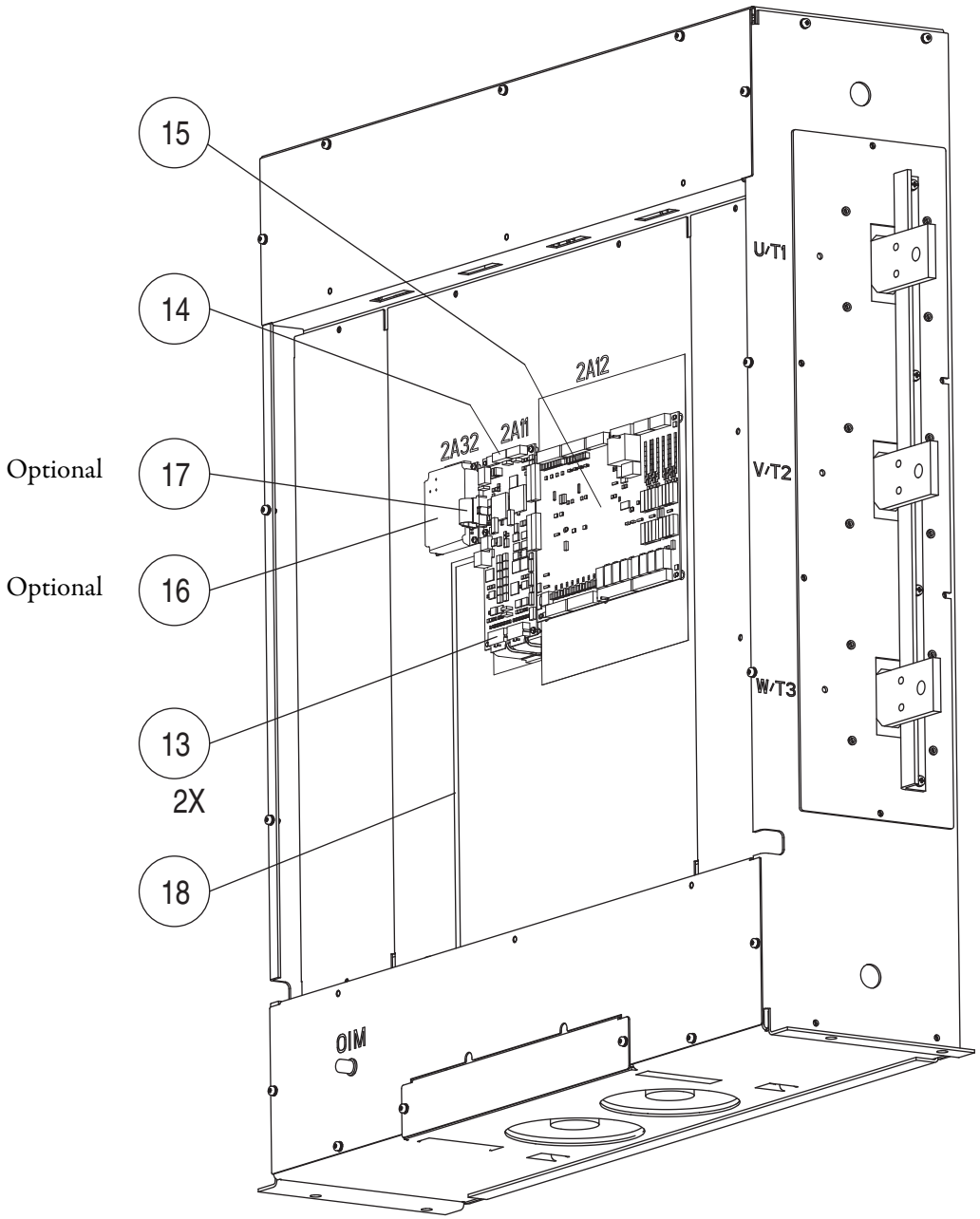


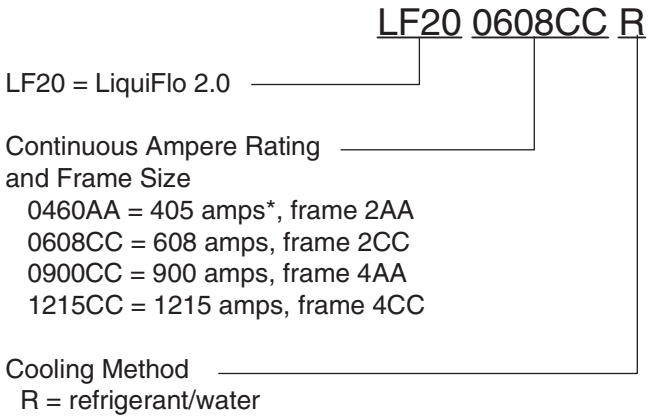
Figure 7 - Power Module Component Locations - Front Panel Removed (Frame 4)


15
14
Optional
17
Optional
16
13
2X
18
2A12
2A32
2A11
U/T1
V/T2
W/T3
OIM

Identifying the Power Module by Model Number

Each LiquiFlo 2.0 AC power module is identified by its model number. See Figure 8. This number appears on the shipping label and on the nameplate of the power module. Power ratings are provided in Table 2.

Figure 8 - Identifying the Power Module Model Number


LF20 0608CC R
LF20 = LiquiFlo 2.0
Continuous Ampere Rating
and Frame Size
0460AA = 405 amps*, frame 2AA
0608CC = 608 amps, frame 2CC
0900CC = 900 amps, frame 4AA
1215CC = 1215 amps, frame 4CC
Cooling Method
R = refrigerant/water

* 460 A with refrigerant, 405 A with water as coolant

Table 2 - Drive Assembly and Power Module Ratings

Drive Assembly ID Number	Power Module Model Number	Enclosure Rating	Input Power (KVA)	Input Voltage (V)	Input Current(2) (Amps)	Output Current at 2 kHz(3) (Amps)
180264-A03	LF200460AAR	NEMA 1	337	480 ±10%	405	405
180264-A06	LF200608CCR		505		608	608
180580-A07	LF200900CCR		673		900	900
180580-A09(1)	LF201215CCR		1010		1215	1215

(1) No overload rating for 180580-A09. 100% output current capability.
(2) 460 A with refrigerant, 405 A with water as coolant.
(3) 110% output current capability for one minute, 150% output current capability for 5 sec.

AC Line I/O Board Description (Frame 3 Only)

The following signals are available at the AC Line I/O board terminal block. The AC Line I/O board is labeled as item 21 in Figure 4. See Figure 9 for terminal identification.

Digital Inputs

The AC Line I/O board terminal block provides terminals for four digital inputs (terminals 22...26). These digital inputs cannot be configured.

Digital Outputs

The AC Line I/O board terminal provides terminals for six digital outputs that are non user-configurable terminals 5...16 and 27...32. The state of these six outputs can be changed by writing to inverter parameter Appl Digital Out (30). Digital output 1 is always connected to the shunt trip circuit; do not use digital output 1 for anything else.

The digital output devices are form C relays capable of switching 250V AC at 8 A or 30V DC at 8 A.

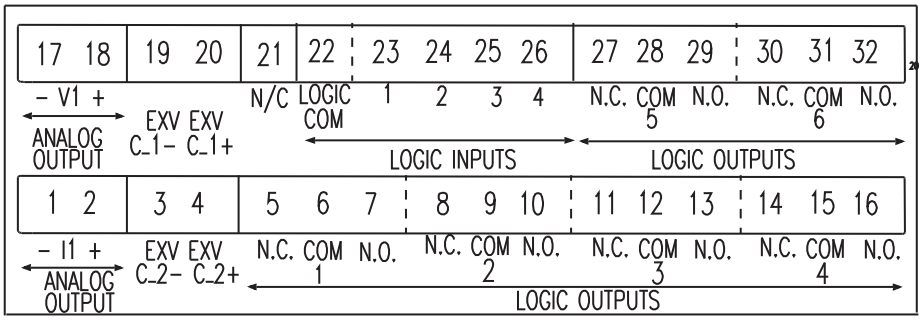
Analog Inputs

The AC Line I/O board contains no component hardware for user-configurable analog inputs.

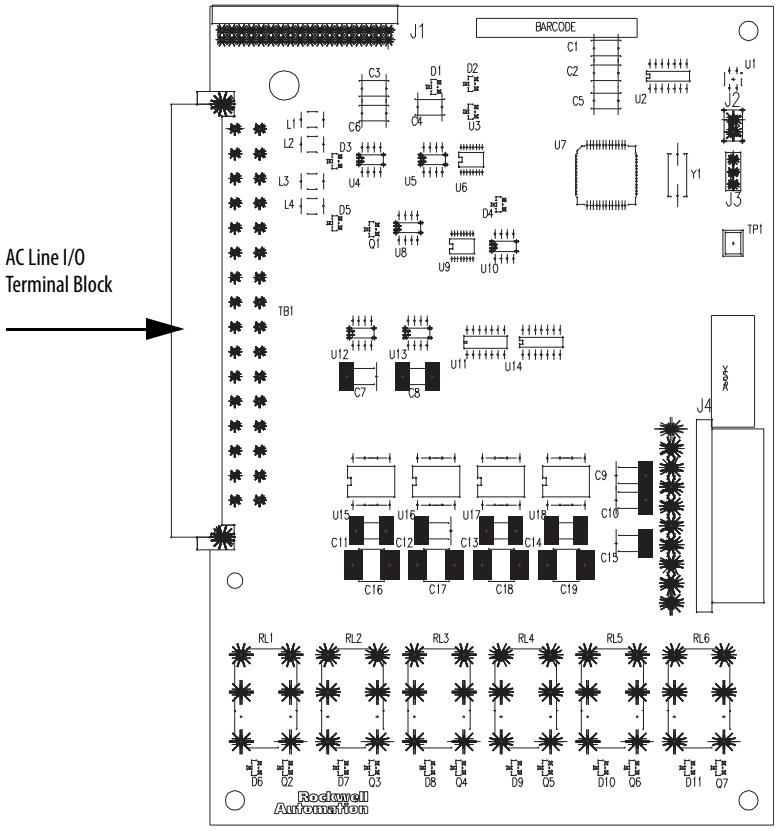
Analog Outputs

The AC Line I/O board terminal block provdes terminals for two special purpose analog outputs, using terminals 1-2 and 17-18. These outputs are not user-configurable.

Figure 9 - AC Line I/O Board (Frame 3)



AC Line I/O Terminal Block (detail)



AC Line I/O Board

Standard I/O Board Description (Frame 3 Only)

The Standard I/O board is offered as an option for Frame 3 LiquiFlo 2.0 drives. The following signals are available at the Standard I/O board. The Standard I/O board is labeled as item 24 in Figure 4. See Figure 10 for terminal identification.

Digital Inputs

The Standard I/O board terminal block provides terminals (27...32) for six user-configurable digital inputs. These inputs can be configured using the inverter digital input selection parameters (361...366).

Digital Outputs

The Standard I/O board terminal block provides terminals for two user-configurable digital outputs (terminals 11...16). These logic outputs can be configured for any of the 30 functions controlled by Digital Out1 Sel (380) and Digital Out2 Sel (384).

The digital output devices are form C relays capable of switching 250V AC at 8 A or 30V DC at 8 A.

Analog Inputs

The standard I/O board terminal block provides two user-configurable terminals for analog inputs (terminals 1...4 and 17...20). Configure the inputs using inverter parameters Anlg In Config through Analog In 2 Loss (320...327). Each analog input has two modes: voltage-sensing (input senses -10 V...10 V) and current-sensing (input senses 0 mA...20 mA). Separate terminals on the standard I/O board are used for each mode.

The mode for both inputs are selected via inverter parameter Anlg In Config (320). If the bit corresponding to a particular analog input is set to 1, then the analog input is in current-sensing mode; if set to 0 it is in voltage-sensing mode.

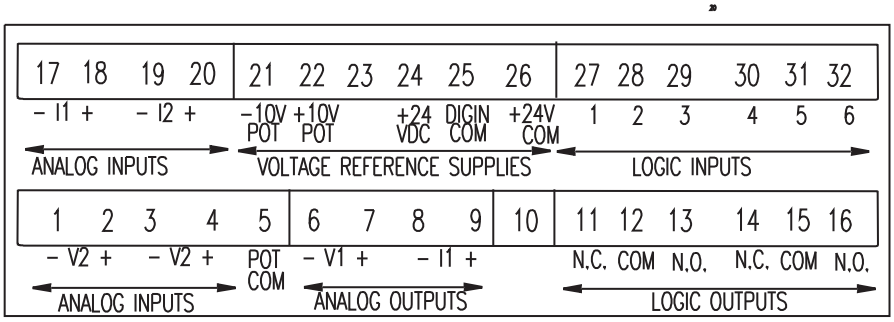
The following table describes the correspondence between the mode of each user-configurable analog input and the standardI/O board terminals that should be used.

Input and Mode	Paramter 320 Setting	Terminal Designators	Terminal Numbers
Analog input 1, voltage-sensing	Bit 0 = 0	V1+, V1-	1, 2
Analog input 1, current-sensing	Bit 0 = 1	I1+, I2-	17, 18
Analog input 2, voltage-sensing	Bit 1 = 0	V2+, V2-	3, 4
Analog input 2, current-sensing	Bit 1 = 1	I1+, I2-	19, 20

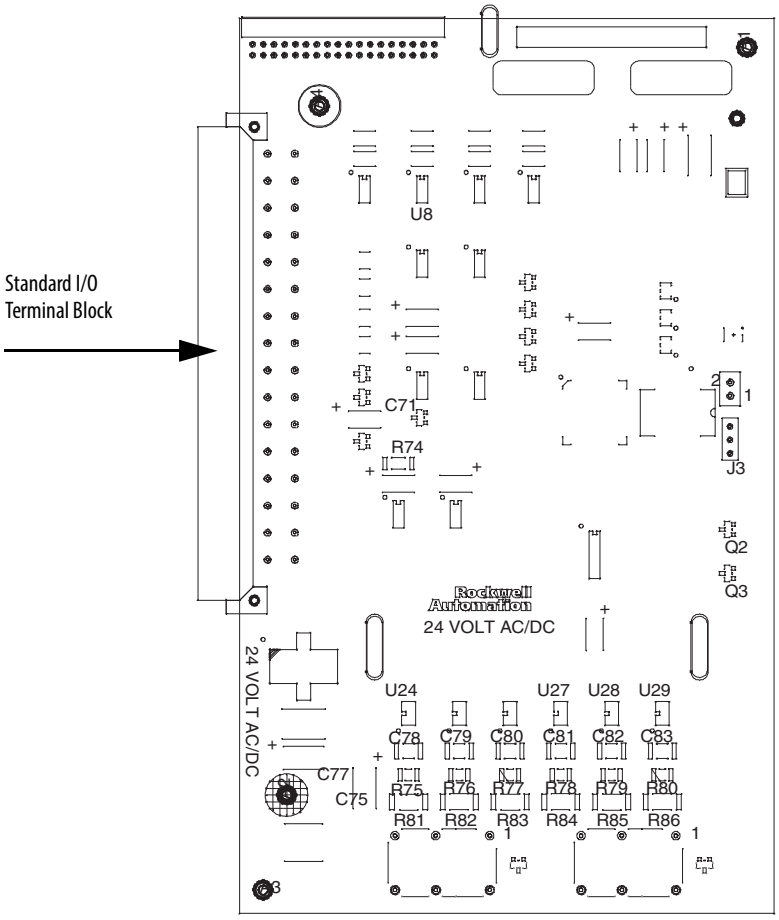
Analog Outputs

The single analog output channel can be configured using Analog Out Config (340) and Analog Out1 Sel (342) to select any one of 31 analog outputs. Terminals 8 and 9 output 4...20 mA. Terminals 6 and 7 output 0...10 V.

Figure 10 - Standard I/O Board (Frame 3)


17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
– I1 + – I2 + –10V +10V +24 DIGIN +24V
POT POT VDC COM COM
1 2 3 4 5 6
ANALOG INPUTS
VOLTAGE REFERENCE SUPPLIES
LOGIC INPUTS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
– V2 + – V2 + POT – V1 + – I1 +
COM
N.C. COM N.O. N.C. COM N.O.
ANALOG INPUTS
ANALOG OUTPUTS
LOGIC OUTPUTS

Standard I/O Terminal Block (Detail)

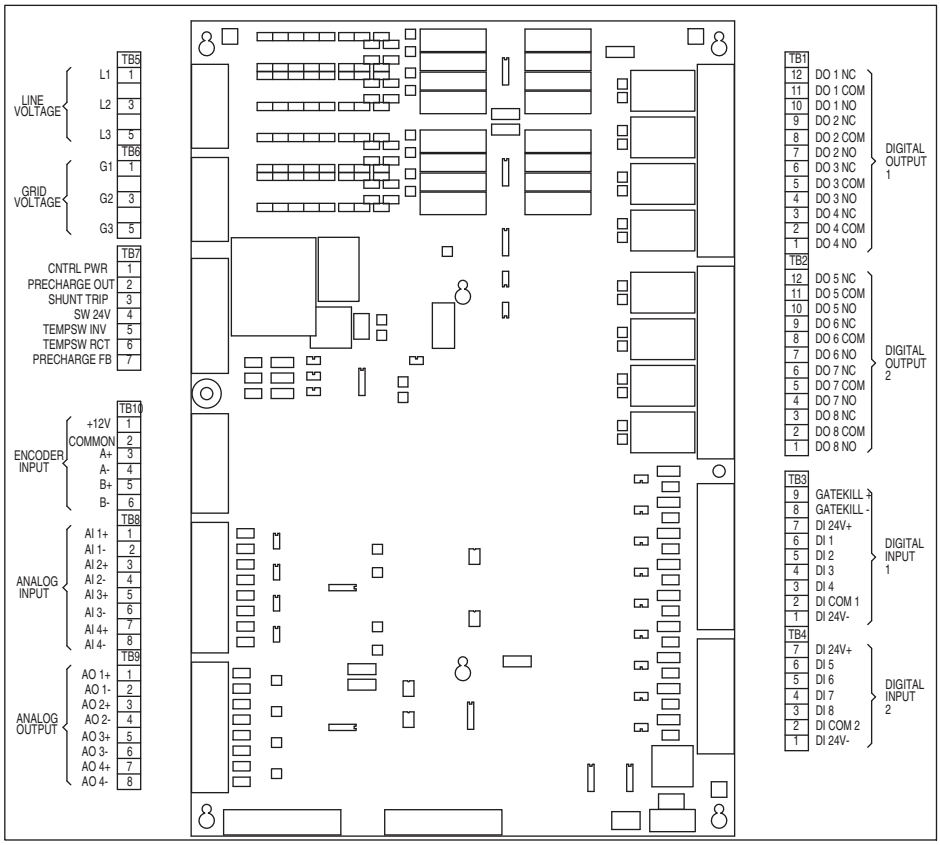


Standard I/O Board

Combined I/O Board Description (Frame 4 Only)

Figure 11 shows terminal block locations on the Combined I/O Board.

Figure 11 - Combined I/O Board (Frame 4)



Digital Inputs

The combined I/O board provides hardware for six user-configurable digital inputs, using connector positions designated DI3...DI8. The following table shows the correspondence between the digital input and the inverter parameter used to configure it.

Inverter Parameter Number	Inverter Parameter Name	Connector Position Designator
361	Digital In1 Sel	DI3
362	Digital In2 Sel	DI4
363	Digital In3 Sel	D15
364	Digital In4 Sel	DI6
365	Digital In5 Sel	DI7
366	Digital In6 Sel	DI8

The states of all six user-configurable digital inputs are visible in inverter parameter Dig In Status (216).

The digital inputs that use connector positions DI1 and DI2 on the combined I/O board are not user-configurable. The status of these two digital inputs are visible in rectifier parameter Dig In Status (216).

Digital Outputs

The combined I/O board provides two user-configurable digital outputs, using connector positions designated DO1 and DO2. These two digital outputs are configured using inverter parameters Digital Out1 Sel through Digital Out2 Off Time (380...387).

The combined I/O board contains six special purpose digital outputs, using connector positions designated DO3...DO8. The state of these six outputs can be changed by writing to inverter parameter Appl Digital Out (30).

All eight digital output devices are form C relays capable of switching 250V AC at 8 A, or 30V DC at 8 A.

The combined I/O board also contains dedicated terminals for driving the shunt trip circuit.

Analog Inputs

The combined I/O board provides two user-configurable analog inputs. Configure the inputs using inverter parameters Anlg In Config through Analog In 2 Loss (320...327). Each analog input has two modes: voltage-sensing (input senses -10 V...10 V) and current-sensing (input senses 0 mA...20 mA). Separate terminals on the standard I/O board are used for each mode.

The mode for both inputs are selected via inverter parameter Anlg In Config (320). If the bit corresponding to a particular analog input is set to 1, then the analog input is in current-sensing mode; if set to 0 it is in voltage-sensing mode.

The following table describes the correspondence between the mode of each user-configurable analog input and the combined I/O board terminals that should be used.

Input and Mode	Paramter 320 Setting	Combined I/O Board Designator
Analog input 1, voltage-sensing	Bit 0 = 0	AI1
Analog input 1, current-sensing	Bit 0 = 1	AI2
Analog input 2, voltage-sensing	Bit 1 = 0	AI3
Analog input 2, current-sensing	Bit 1 = 1	AI4

Analog Outputs

The combined I/O board contains one user-configurable analog output. The output is configurable using inverter parameters Anlg Out Config through Analog Out1 Lo (340...344). The analog output has two modes: voltage (output at -10 V...10 V) and current (output at 0 mA...20 mA). Separate terminals on the combined I/O board are used for each mode.

The mode is selected via inverter parameter Anlg Out Config (340). In this parameter, if the lowest bit is set to 1, then the analog output is in voltage mode; if set to 0 it is in current mode.

The following table describes the correspondence between the mode of the user-configurable analog output and the combined I/O board terminals that should be used.

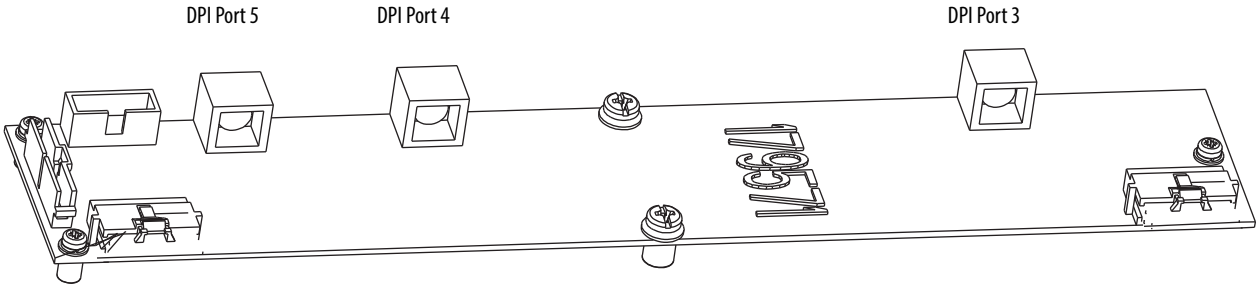
Mode	Parameter 340 Setting	Combined I/O BoardDesignator
Analog Output, voltage	Bit 0 = 0	AO3
Analog Output, current	Bit 0 = 1	AO4

The combined I/O board contains two special purpose analog outputs: AO1 and AO2. These outputs are not user-configurable.

DPI Communication Ports

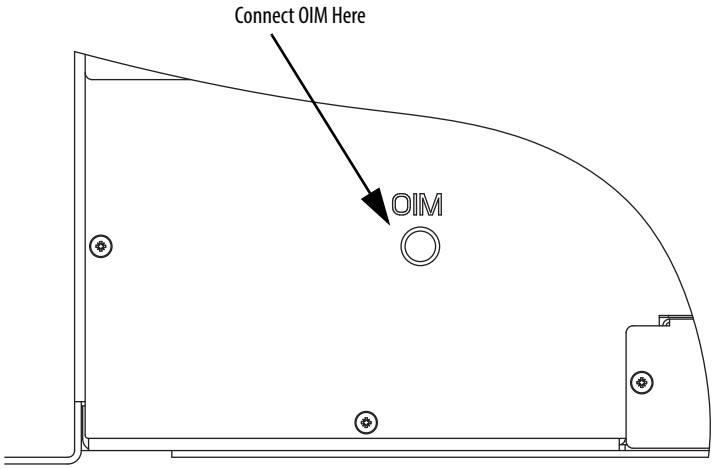
For Frame 3 drives, the Communication Interface board contains three DIN connectors that are used as DPI communication ports (Figure 12). These ports provide communication between the LiquiFlo 2.0 drive and other DPI devices (for example, an OIM or a personal computer running the VS Utilities software). The three connectors (DPI ports 3, 4, and 5) are equivalent. This manual assumes that peripherals are always plugged into DPI port 3.

Figure 12 - DPI Communication Interface Board (Frame 3)



For Frame 4 drives, there is only one DPI port, accessible via the OIM connector on the front panel of the power module (see Figure 13). An internal cable connects this connector to the DIN connector on the control board. A device plugged directly into this connector uses DPI port 3. If there is a requirement that multiple DPI peripheral devices be connected, a DPI port expander box can be used, but no device should be plugged into the DPI Port 2 connector because the rectifier connects to the inverter using that port.

Figure 13 - Power Module Bottom Left Front View (Frame 4)



Optional Equipment

Table 3 lists standard LiquiFlo 2.0 kits and options.

Table 3 - Available LiquiFlo 2.0 Kits and Options

Description	Model Number	Instruction Manual
Operator Interface Module (OIM)	RE1LCD	LiquiFlo 2.0 AC Drive User Manual, publication D2-3518. See Using the OIM on page 235.
OIM LCD Hand-held Cable	RECBL-LCD	N/A
OIM Door-mount Bezel Kit	REBZL-N1	MD60/MD65 Door-Mount NEMA 1 OIM Bezel Kit (MDI) Instruction Manual, publication D2-3517
Serial Converter with VS Utilities Software	RECOMM-232	VS Utilities Getting Results Manual, publication D2-3488

Notes:

Planning the Installation

This chapter provides information for planning a LiquiFlo 2.0 drive installation.

	ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.
	ATTENTION: Use of power factor correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power factor correction capacitors before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.
	ATTENTION: You are responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

General Requirements for the Installation Site

Always properly plan the installation before installing a LiquiFlo 2.0 drive to be sure that the environment and operating conditions are satisfactory. Read the following recommendations before continuing with drive installation.

Making Sure Environmental Conditions are Met

Before deciding on an installation site, consider the following guidelines:

- Verify that NEMA/UL Type 1 enclosure drives can be kept clean and dry.
- Verify that the area chosen allows for proper airflow. See Verifying the Site Provides for Recommended Air Flow Clearances on page 41.
- Be sure that the NEMA/UL Type 1 enclosure is installed away from oil, coolants, and other airborne contaminants.
- Do not install the drive above 1000 m (3300 ft) without derating output power. For every 91.4 m (300 ft) above 1000 m (3300 ft), derate the output current 1%.
- Verify that the drive location meets the environmental conditions specified in Table 4.
- Floor-mounted units should be attached to the floor with the C-channel rails provided. See Figure 14 and Figure 16.

Table 4 - Environmental Conditions

Condition	Specification
Operating Temperature (inside NEMA/UL Type 1 enclosure)	0…55 °C[1] (32…131 °F)
Ambient Temperature (outside NEMA/UL Type 1 enclosure)	0…40 °C (32…104 °F)
Storage Temperature (Ambient)	-40…65 °C (-40…149 °F)
Humidity	5%...95% (non-condensing)

(1) With typical heat rise inside a cabinet, 40 °C (104 °F) ambient outside usually results in 55 °C (131 °F) inside.

Determining Total Area Required Based on Drive Dimensions

Overall **drive dimensions** are identified in these figures:

- Frame 3 drives 180264-A03 and 180264-A06 in Figure 14
- Frame 4 drives 180580-A07 and 180580-A09 in Figure 16

Overall **power module dimensions** are identified in these figures:

- Frame 3 power modules LF200460AAR and LF200608CCR in Figure 15
- Frame 4 power modules LF200900CCRand LF201215CCR in Figure 17

Figure 14 - Exterior Enclosure Dimensions - 180264-A03 and 180264-A06 (Frame 3), in. (mm)

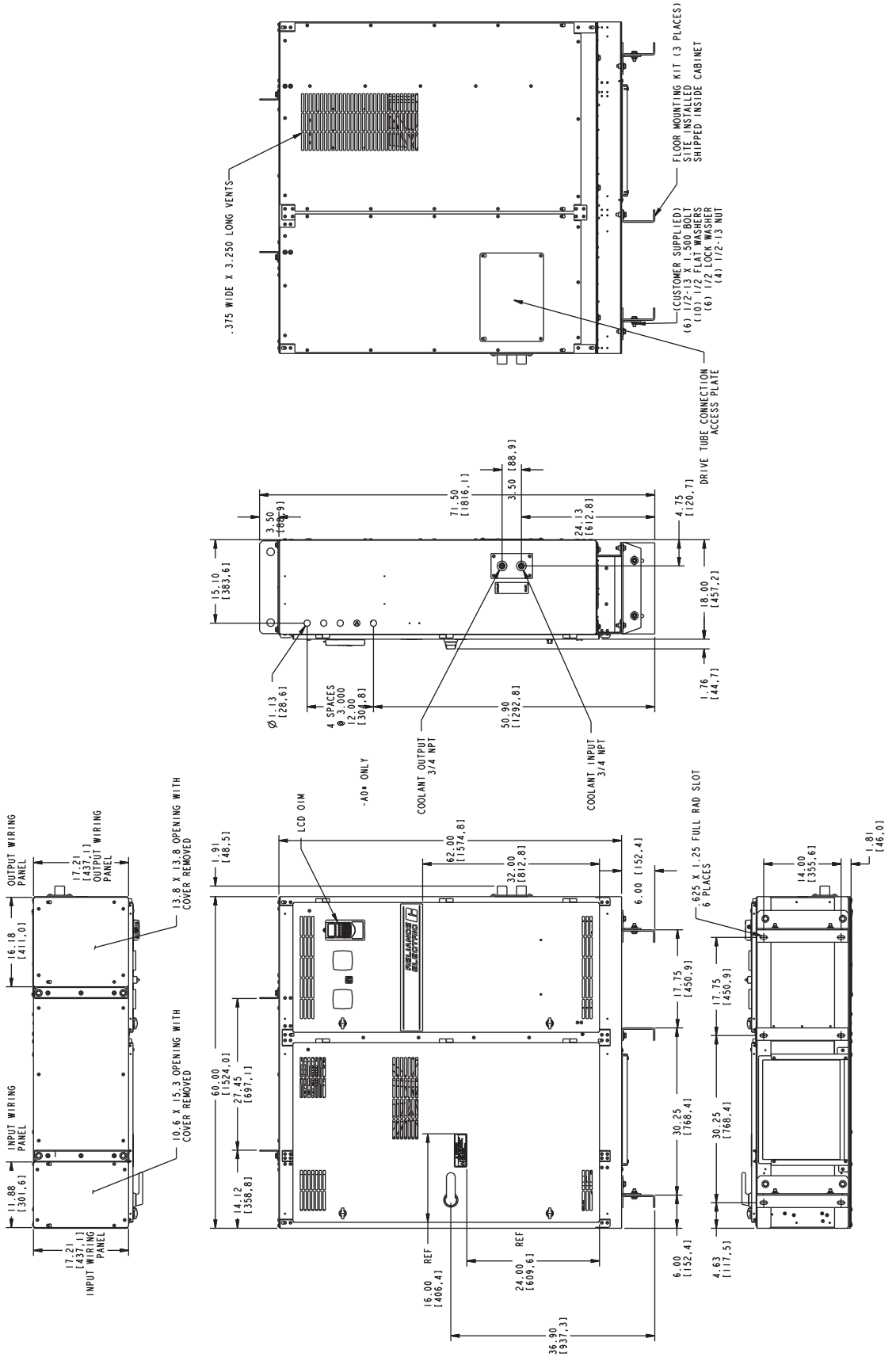
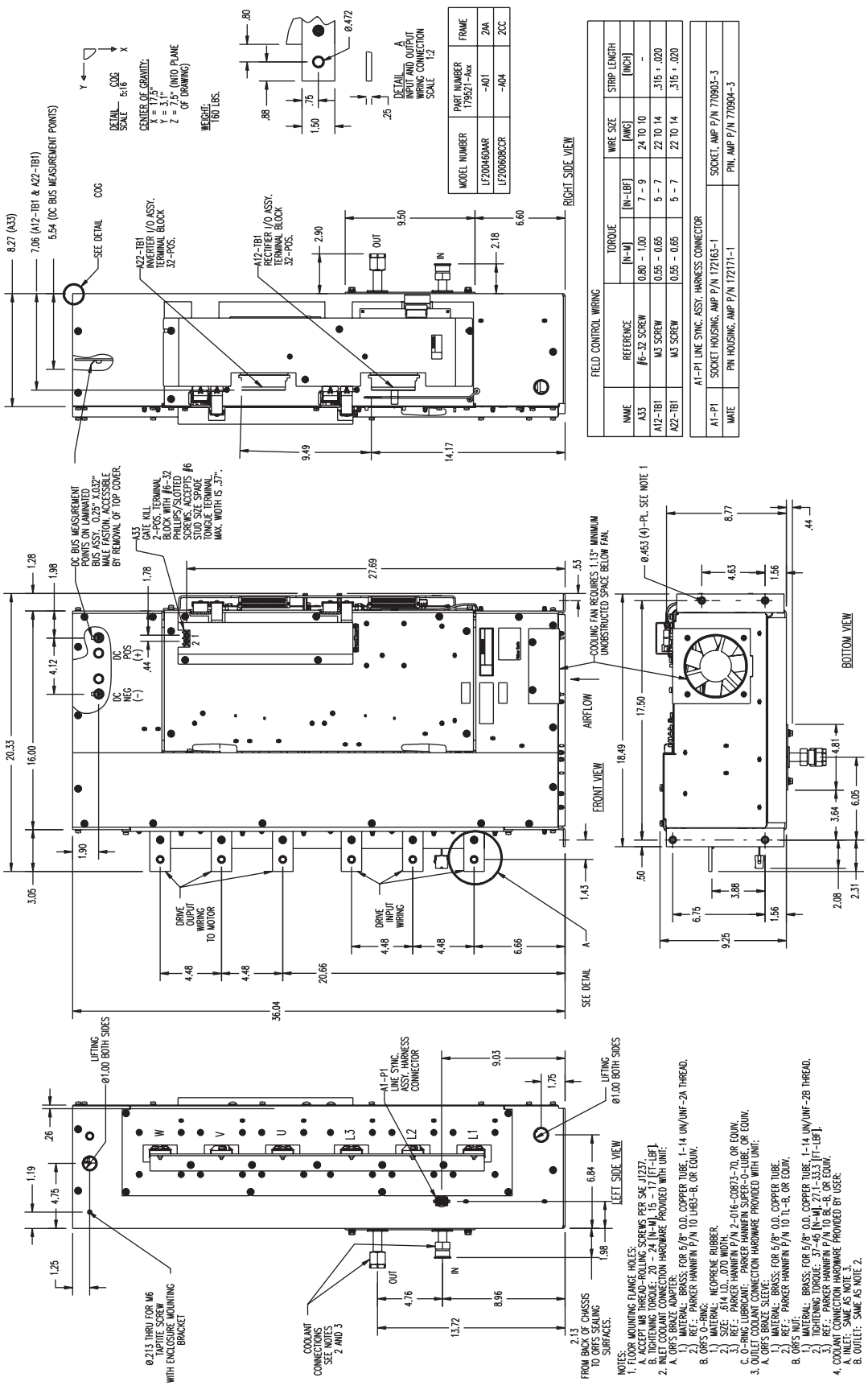


Figure 15 - Power Module Dimensions - LF200460AAR and LF200608CCR (Frame 3), in.


RIGHT SIDE VIEW
FRONT VIEW
BOTTOM VIEW
LEFT SIDE VIEW
SEE DETAIL
DETAIL A
INPUT AND OUTPUT WIRING CONNECTION SCALE 1:2
DETAIL COG SCALE 5:16
CENTER OF GRAVITY: X = 17.5" Y = 3.1" Z = 7.5" (INTO PLANE OF DRAWING)
WEIGHT: 160 LBS.
A22-TB1 INVERTER I/O ASSY. TERMINAL BLOCK 32-POS.
A12-TB1 RECTIFIER I/O ASSY. TERMINAL BLOCK 32-POS.
DC BUS MEASUREMENT POINTS ON LAMINATED BUS ASSY, 0.25" X 0.32" MALE FASTON, ACCESSIBLE BY REMOVAL OF TOP COVER.
A33 GATE KILL 2-POS. TERMINAL BLOCK WITH #6-32 PHILLIPS/SLOTTED SCREWS, ACCEPTS #6 STUD SIZE SPADE TONGUE TERMINAL, MAX. WIDTH IS .37".
DC NEG (-)
DC POS (+)
DRIVE OUTPUT WIRING TO MOTOR
DRIVE INPUT WIRING
COOLING FAN REQUIRES 1.13" MINIMUM UNOBSTRUCTED SPACE BELOW FAN.
AIRFLOW
Ø.453 (4)-PL, SEE NOTE 1
A1-P1 LINE SYNC. ASSY. HARNESS CONNECTOR
LIFTING Ø1.00 BOTH SIDES
Ø.213 THRU FOR M6 TAPTITE SCREW WITH ENCLOSURE MOUNTING BRACKET
COOLANT CONNECTIONS SEE NOTES 2 AND 3
FROM BACK OF CHASSIS TO DRFS SEALING SURFACES.
IN
OUT
L1
L2
L3
U
V
W
NOTES:
1. FLOOR MOUNTING FLANGE HOLES:
A. ACCEPT M8 THREAD-ROLLING SCREWS PER SAE J1237.
B. TIGHTENING TORQUE: 20 - 24 [N-M] 15 - 17 [FT-LBF].
2. INLET COOLANT CONNECTION HARDWARE PROVIDED WITH UNIT:
A. DRFS BRAZE ADAPTER:
1.) MATERIAL: BRASS; FOR 5/8" O.D. COPPER TUBE, 1-14 UN/UNF-2A THREAD.
2.) REF.: PARKER HANNIFIN P/N 10 LHB3-B, OR EQUIV.
B. DRFS O-RING:
1.) MATERIAL: NEOPRENE RUBBER.
2.) SIZE: .614 I.D., .070 WIDTH.
3.) REF.: PARKER HANNIFIN P/N 2-016-C0873-70, OR EQUIV.
C. O-RING LUBRICANT: PARKER HANNIFIN SUPER-O-LUBE, OR EQUIV.
3. OUTLET COOLANT CONNECTION HARDWARE PROVIDED WITH UNIT:
A. DRFS BRAZE SLEEVE:
1.) MATERIAL: BRASS; FOR 5/8" O.D. COPPER TUBE.
2.) REF.: PARKER HANNIFIN P/N 10 TL-B, OR EQUIV.
B. DRFS NUT:
1.) MATERIAL: BRASS; FOR 5/8" O.D. COPPER TUBE, 1-14 UN/UNF-2B THREAD.
2.) TIGHTENING TORQUE: 37-46 [N-M], 27.1-33.3 [FT-LBF].
3.) REF.: PARKER HANNIFIN P/N 10 BL-B, OR EQUIV.
4. COOLANT CONNECTION HARDWARE PROVIDED BY USER:
A. INLET: SAME AS NOTE 3.
B. OUTLET: SAME AS NOTE 2.

MODEL NUMBER	PART NUMBER 179521-Axx	FRAME
LF200460AAR	-A01	2AA
LF200608CCR	-A04	2CC

FIELD CONTROL WIRING				
		TORQUE		WIRE SIZE	STRIP LENGTH
NAME	REFERENCE	[N-M]	[IN-LBF]	[AWG]	[INCH]
A33	#6-32 SCREW	0.80 - 1.00	7 - 9	24 TO 10	-
A12-TB1	M3 SCREW	0.55 - 0.65	5 - 7	22 TO 14	.315 +.020
A22-TB1	M3 SCREW	0.55 - 0.65	5 - 7	22 TO 14	.315 +.020

A1-P1 LINE SYNC. ASSY. HARNESS CONNECTOR	
A1-P1	SOCKET HOUSING, AMP P/N 172163-1
MATE	PIN HOUSING, AMP P/N 172171-1

SOCKET, AMP P/N 770903-3	
PIN, AMP P/N 770904-3	

Figure 16 - Exterior Enclosure Dimensions - 180580-A07 and 180580-A09 (Frame 4), in.

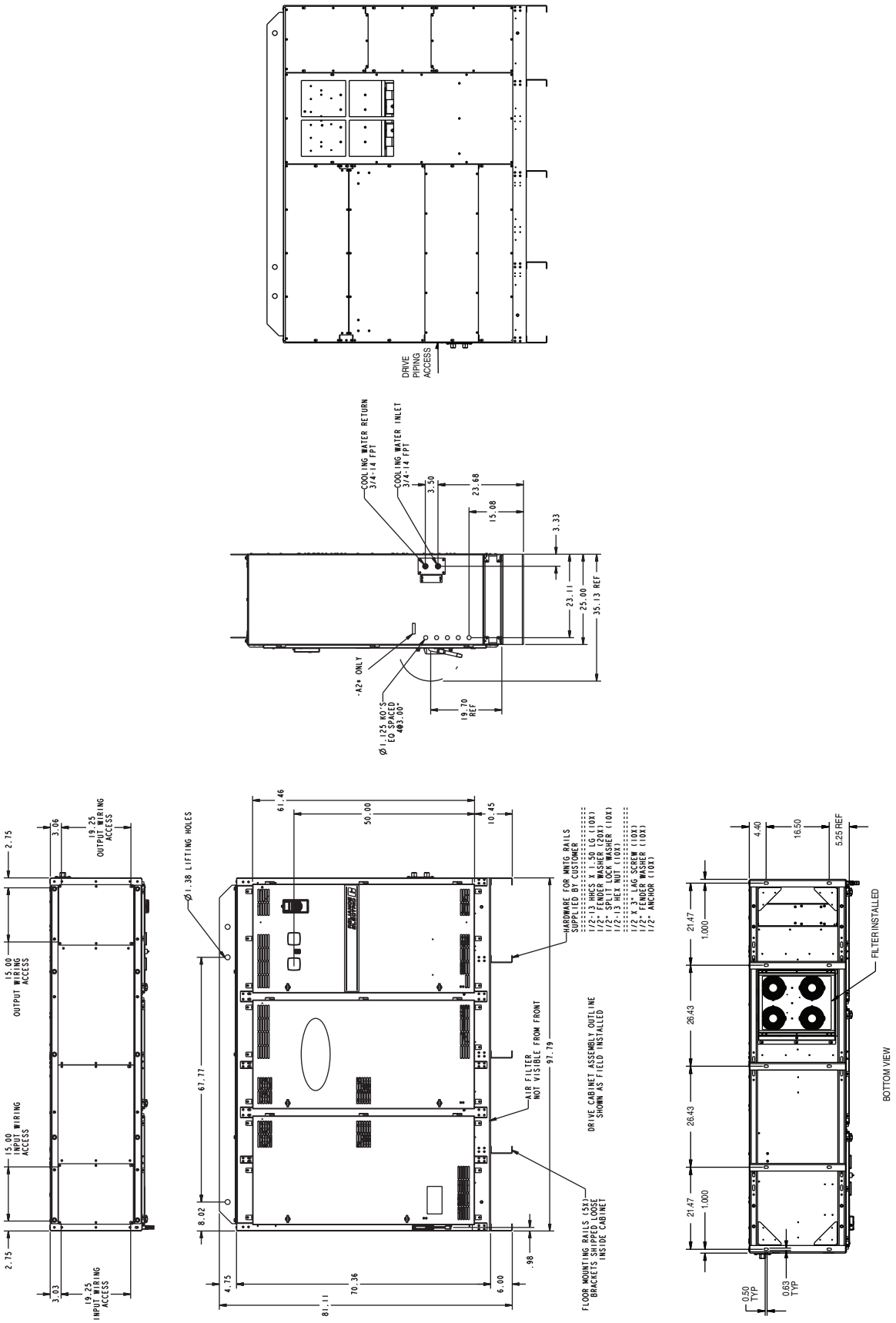
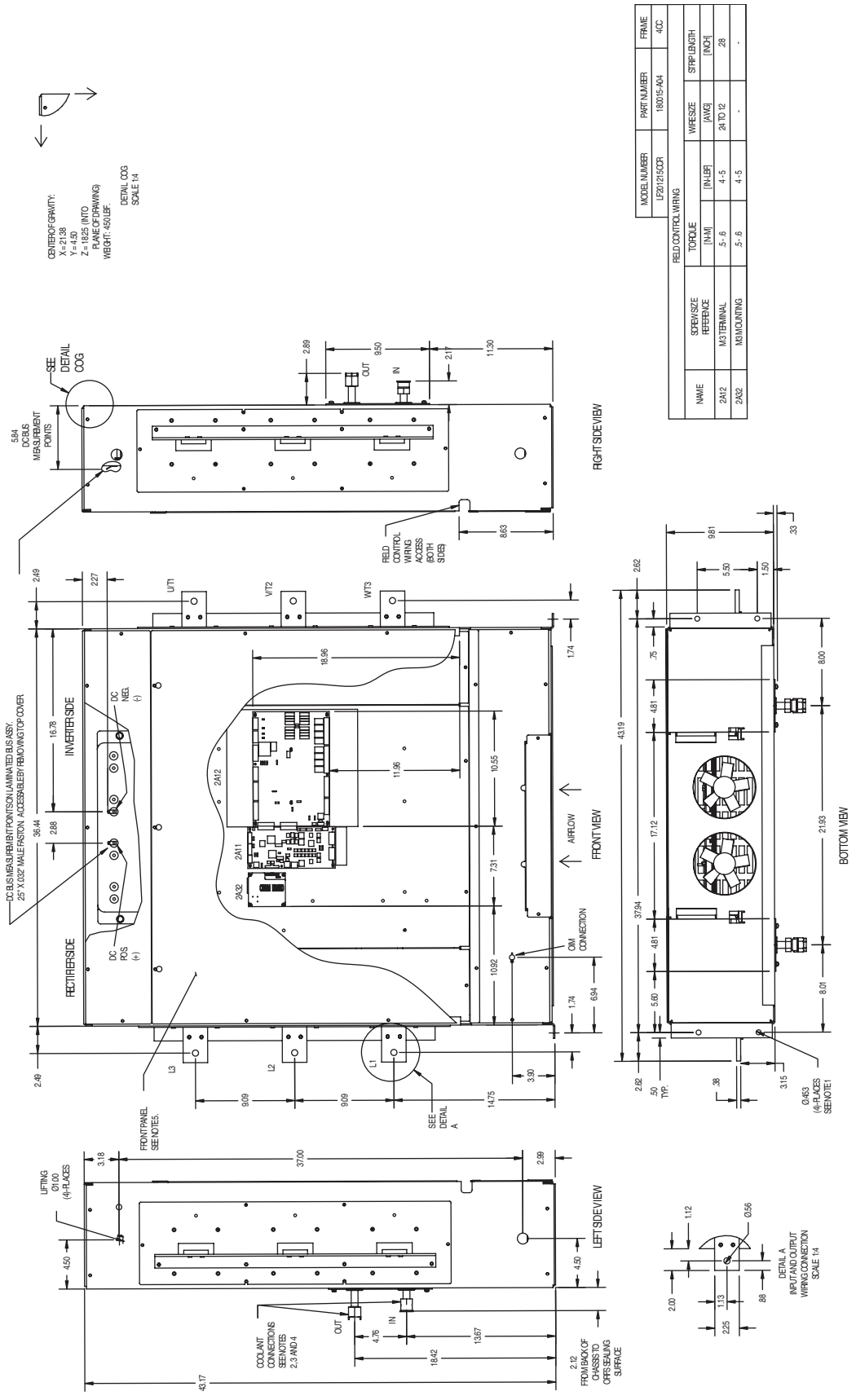


Figure 17 - Power Module Dimensions - LF200900CCRand LF201215CCR (Frame 4), in.



Verifying the Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air circulation around the enclosure. A **6-inch minimum clearance** is required wherever vents are located in the cabinet.

Verifying Power Module Input Ratings Match Supplied Power

Verify that plant power meets the input power requirements of the power module circuitry for the LiquiFlo 2.0 drive. See Table 2 on page 24 for input power rating specifications. Be sure input power to the power module corresponds to the nameplate voltage, current, and frequency of the power module.

Wiring Requirements for the Drive

Evaluate the input power wire sizes, branch circuit protection, and control wiring before continuing with the drive installation (Chapter 6).

Determining Wire Size Requirements

Determine wire size based on current requirements, size of conduit openings, and applicable local, national, and international codes (for example, NEC/CEC regulations).

ATTENTION: You are responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Conduit Entry Opening Sizes

Determine the size of the conduit openings in the cabinet that the drive is mounted in so that the wire planned for a specific entry point will fit through the opening.

Recommended Power Wire Sizes

Use copper input power wiring that is sized according to applicable codes to handle the continuous-rated input current of the drive. Use copper output wiring that is sized according to applicable codes to handle the continuous-rated output current of the drive.

Recommended Control and Signal Wire Sizes

The recommended wire size to connect I/O signals to the control terminal block is 4 mm^2 (12 AWG). Recommended terminal tightening torque is 0.8...1 N•m (7...9 lb•in).

Recommended Motor Lead Lengths

Motor lead lengths can total up to 76 m (250 ft).

Verifying Power Module Output Current Rating Is Greater Than Chiller Running Load Amps

Verify that the LiquiFlo 2.0 power module output current rating is equal to or greater than the running load amps (RLA) of the chiller. Table 2 on page 24 lists the output current values.

Stopping the Drive

ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this emergency stop circuit is not implemented. Failure to observe this precaution could result in bodily injury.

Depending on the requirements of the application, the LiquiFlo 2.0 drive can be programmed to provide either a coast-to-rest or a ramp-to-rest operational stop without physical separation of the power source from the motor.

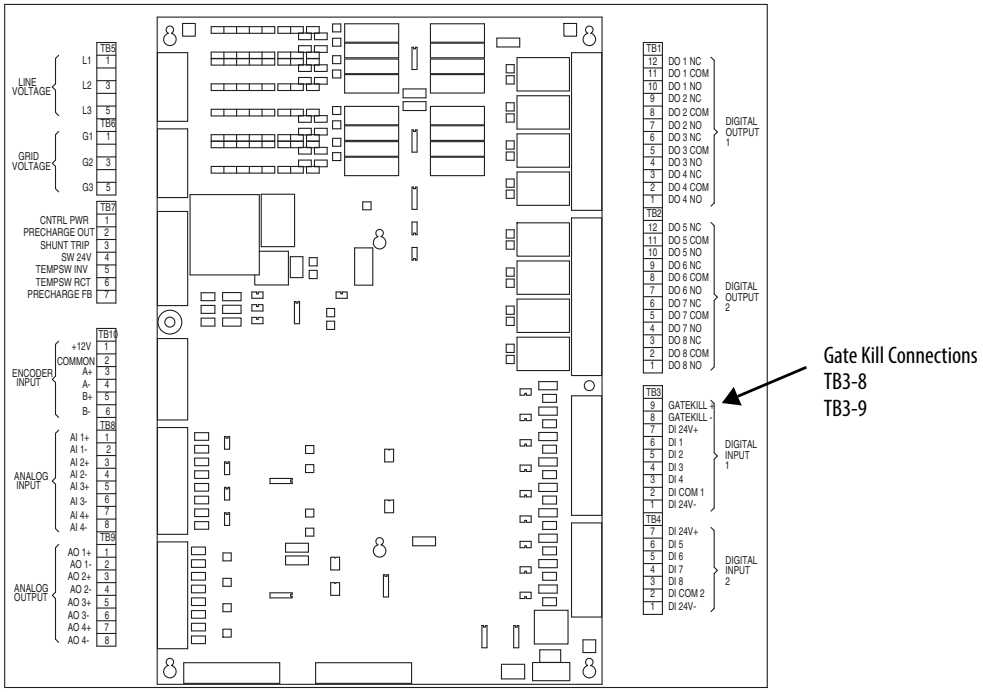
- A **coast-to-rest** stop turns off the gate drive to the IGBT power devices.
- A **ramp-to-rest** stop continues to fire the IGBT power devices in a controlled manner until the motor comes to a stop, and then turns off the power devices.

You can also program zero speed with power maintained to the motor, but in this condition, the drive is not actually stopped.

In addition to the operational stop, the LiquiFlo 2.0 power module provides a hardwired **gate kill**. This function provides a two-wire emergency stop circuit that does not depend on software or on the transmission of commands over a communications network. When the two-wire circuit is opened, the gate drive to the IGBTs is removed.

In Frame 3, the gate kill function is provided by a two-position terminal block (A33) located on the power module. See Figure 18 for gate kill connections in Frame 4.

Figure 18 - Frame 4 Combined I/O (partial view) with Gate Kill Connections



Notes:

Mounting The Power Module and Grounding the Drive

This chapter shows how to mount and properly ground the drive.

Lifting and Mounting the Drive

Be careful to prevent damage due to dropping or jolting when moving the drive. A forklift truck or similar means of lifting and transporting may be used. Sling in a manner that equalizes the load at the lifting points. Use a spreader bar if the angle of the sling is less than 45 degrees relative to horizontal. Do not jolt while lifting.

Figure 19 - Lift Point Locations for LiquiFlo 2.0 Drives (Frame 3)

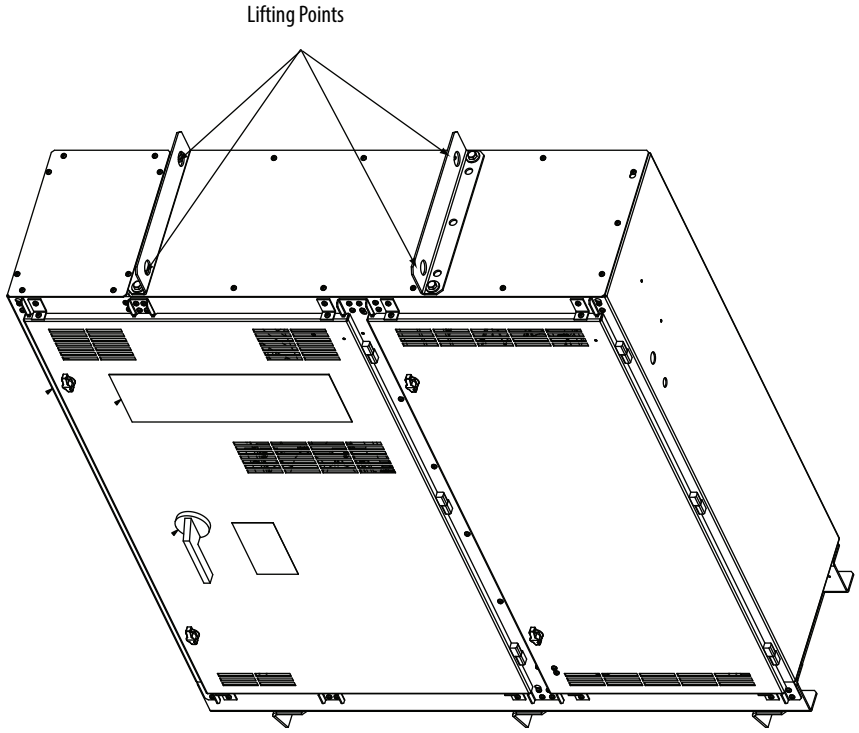
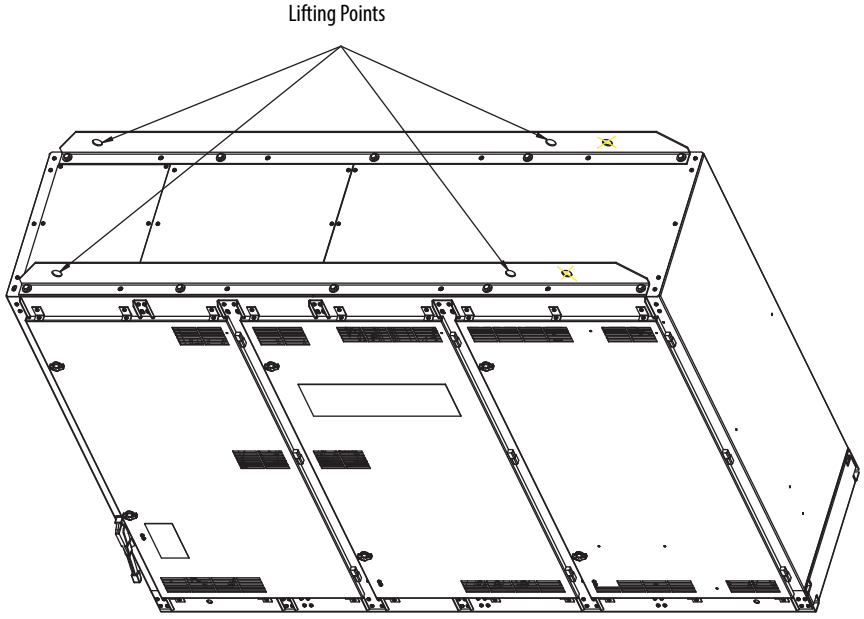


Figure 20 - Lift Point Locations for LiquiFlo 2.0 Drives (Frame 4)



Use the following procedure to lift and mount the LiquiFlo 2.0 drive:

1. Use an overhead or portable hoist (minimum 2 ton rated capacity) to attach a free-fall chain to the chain secured to the drive. Take up any vertical slack in the chain.
2. Use the hoist to carefully lift the drive from the horizontal shipping pallet.
3. Position the drive.
4. Machine fasten the drive enclosure using 1/2-inch bolts, grade 5 or better, with compression washers. Verify mounting bolt torque specifications.

Grounding the Drive

Use the following steps to ground the drive:

ATTENTION: You are responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. Open the door of the enclosure.
2. Run a suitable equipment grounding conductor unbroken from the drive to earth ground. Recommended tightening torque is 11.3...13.5 N•m (100...120 lb•in). For Frame 3 see Figure 2 on page 15, for Frame 4 see Figure 5 on page 20.

   Note: For grounding the motor, the motor ground cable provided should be used.
3. Close the door of the enclosure.

Lifting and Mounting the Power Module

Be careful to prevent damage due to dropping or jolting when moving the drive. A forklift truck or similar means of lifting and transporting may be used. Sling in a manner that equalizes the load at the lifting points. Use a spreader bar if the angle of the sling is less than 45 degrees relative to horizontal. Do not jolt while lifting.

Figure 21 - Lift Point Locations for LiquiFlo 2.0 Power Module (Frame 3)

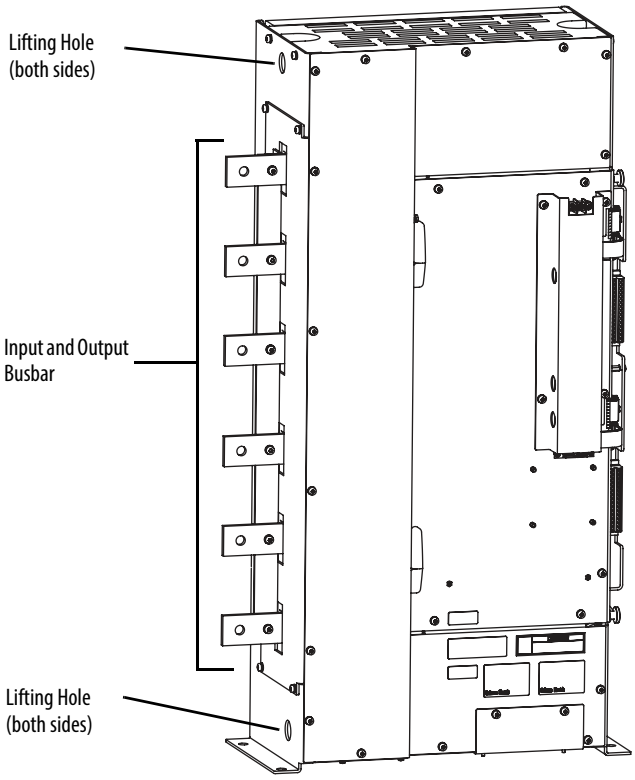
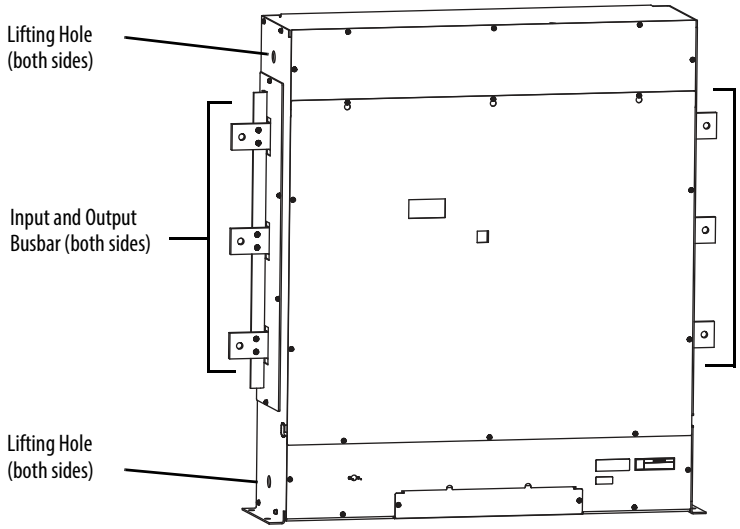


Figure 22 - Lift Point Locations for LiquiFlo 2.0 Power Module (Frame 4)



Use the following procedure to lift and mount the LiquiFlo 2.0 power module:

ATTENTION: Do not use input and output busbars for lifting or handling. Otherwise, damage to equipment may result.

ATTENTION: Mechanically support conductors to minimize mechanical load on input and output busbars. Otherwise, damage to equipment may result.

1. Use an overhead or portable hoist (minimum 2 ton rated capacity) to attach a free-fall chain to the chain secured to the power module. Take up any vertical slack in the chain.
2. Use the hoist to carefully lift the power module from the horizontal shipping pallet.
3. Position the power module in the prepared mounting location.
4. Machine fasten the power module enclosure using 1/2-inch bolts, grade 5 or better, with compression washers. Recommended tightening torque is 11.3...13.5 N•m (100...120 lb•in).

Installing Input and Output Power Wiring

Install all wiring in conformance with the applicable local, national, and international codes (for example, NEC/CEC). Signal wiring, control wiring, and power wiring **must** be routed in separate conduits to prevent interference with drive operation. Use grommets, when hubs are not provided, to guard against wire chafing.

Installing Power Wiring from the AC Input Line to the Main Input Circuit Breaker

Use the following steps to connect AC input power to the main input circuit breaker:

1. Turn off, lock out, and tag the input power to the drive.
2. Remove the input wiring panel and drill the required number of openings in the top of the drive enclosure. Take care that metal chips do not enter the enclosure. See Figure 14 on page 37 through Figure 17 on page 40.
3. Wire the AC input power leads by routing them though the openings to the main input circuit breaker.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

4. Connect the three-phase AC input power leads (three-wire 480V AC) to the appropriate input terminals of the circuit breaker. See Figure 2 on page 15 and Figure 5 on page 20.
5. Tighten the AC input power terminals to the proper torque as specified on the input circuit breaker.

Installing Wiring from the Power Module Output Terminals to the Motor

Use the following steps to connect the AC output power wiring from the power module to the motor.

IMPORTANT The total motor lead length must not exceed 76 m (250 ft). See Table 5 for recommended minimum motor lead wire sizes.

1. Turn off, lock out, and tag the input power to the drive. Wait 5 minutes.
2. Remove the input wiring panel and drill the required number of openings for the wiring. See Figure 14 on page 37 and Figure 16 on page 39.
3. Connect the three-phase AC output power motor leads to the power module busbars labeled U, V, and W. See Figure 15 on page 38 and Figure 17 on page 40.
4. Tighten the three-phase AC output power terminals:
   - Frame 3 – M10 Class 8.8 or 3/8 in. Grade 5 fastener. Tighten to 40N•m (30 lb•ft).
   - Frame 4 – M12 Class 8.8 or 1/2 in. Grade 5 fastener. Tighten to 100N•m (75 lb•ft).

Table 5 - Recommended Minimum Motor Lead Wire Size

Power Module Model Number	Minimum Motor Lead Wire Size(1)
LF200460AAR	2 x 2/0 AWG
LF200608CCR	2 x 250 MCM
LF200900CCR	4 x 250 MCM
LF201215CCR	4 x 250 MCM

(1) Motor lead wiring **must** comply with all local and national codes.

Completing the Installation

This chapter provides instructions on how to perform a final check of the installation before power is applied to the drive.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should start and adjust it. Read and understand this manual in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

Checking the Installation

Use the following procedure to verify the condition of the installation:

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait 5 minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Turn off, lock out, and tag the input power to the drive. Wait 5 minutes.
2. Verify that the DC bus voltage is zero. See Verify that the DC Bus Capacitors are Discharged Before Servicing the Drive on page 195.

ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

3. Remove any debris, such as metal shavings, from around the drive.
4. Check that there is adequate clearance around the drive.
5. Verify that the wiring to the terminal strip and the power terminals is correct.
6. Check that the wire size is within terminal specifications and that the wires are tightened properly.
7. Check that user-supplied branch circuit protection is installed and correctly rated.

8. Check that the incoming power is rated correctly.
9. Check the motor installation and length of motor leads.
10. Check that the rating of the transformer (if used) matches the drive requirements and is connected properly.
11. Verify that a properly sized ground wire is installed and a suitable earth ground is used. Check for and eliminate any grounds between the motor frame and the motor power leads. Verify that all ground leads are unbroken.
12. Visually inspect the liquid-cooling connections for leaks.

Powering Up After Installation Is Complete

Use the following procedure to verify that the drive is installed correctly and is receiving the proper line voltage:

1. Turn the input circuit breaker of the drive to the On position.
2. Verify that coolant is flowing through the power module.
3. Follow the start-up procedure in Using the Start-up Routines on page 53.

Using the Start-up Routines

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this chapter in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Incorrect values for some of the parameters in the start-up routines can cause the drive to operate improperly. Verify that the values of these parameters are appropriate for your application. Failure to observe this precaution could result in bodily injury.

For standard applications, the start-up routines on the OIM enable you to configure the most commonly used parameters through a series of steps. This helps you set up the drive as quickly as possible.

For advanced applications, you may need to adjust additional parameters in the parameter list using either the OIM or VS Utilities software.

Preparing for Startup

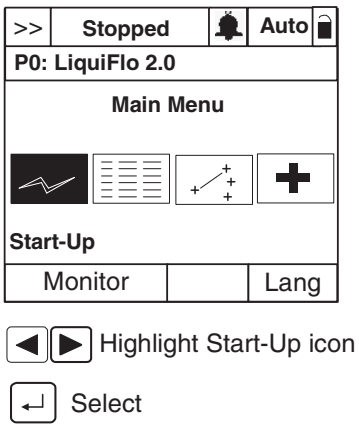
Before performing the start-up routine, you must:

- Be qualified to configure the drive and be familiar with the operation of AC drives.
- Be familiar with the operation of the OIM.
- Have completed all hardware installation.
- Properly connect the drive to the motor.

Running the Start-up Routines

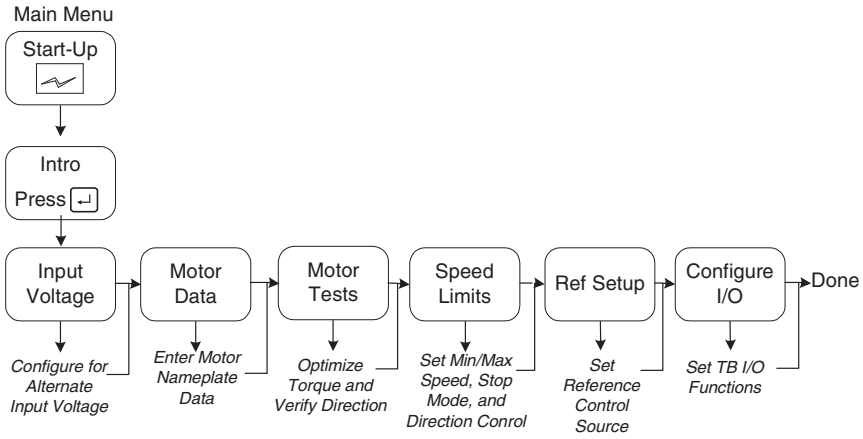
To access the start-up routines, select the Start-Up icon from the main menu as shown in Figure 23

Figure 23 - Accessing the Start-Up Routines



The Start-Up menu screen contains eight selections. The first seven menu items contain the most commonly used parameters associated with each function. See Figure 24.

Figure 24 - Start-Up Menu



The Start-up routine automates the process of entering values of selected parameters by taking you to the next parameter after you accept a parameter value. As each item in the list is completed, you are automatically advanced to the next step.

IMPORTANT Parameter values are saved as they are changed. Pressing ESC/PROG or aborting the Start-up routine does not undo the changes.

Exiting Before Completing the Start-Up Routines

To exit the Start-up routines, press the F4 key (Exit). When you select the Start-up icon from the main menu again, you are prompted to either continue or restart the Start-up routines. If you select **Continue**, you are returned to the point at which you exited.

Programming Basics

To program the drive for a specific application, you adjust the appropriate parameters. The parameters are used to define characteristics of the drive.

This chapter provides an overview of parameter types and how they are organized. Parameter descriptions are provided in Chapter 9.

About Parameters

There are three types of parameters:

Numbered List Parameters	Numbered list parameters allow a selection from two or more options. The OIM displays a text message for each item. Example: inverter Speed Ref A Sel (90)
Bit Parameters	Bit parameters have individual bits associated with features or conditions: • If the bit is **0**, the feature is **off** or the condition is **false**. • If the bit is **1**, the feature is **on** or the condition is **true**. Example: inverter Drive Status 1 (209)
Numeric Parameters	These parameters have a single numerical value (for example, 0.1 V). Example: inverter Maximum Freq (55)

Parameters are also either configurable, tunable, or read-only:

Configurable Parameters	Can be adjusted or changed only while the drive is stopped.
Tunable Parameters	Can be adjusted or changed while the drive is running or stopped.
Read-only Parameters	Cannot be adjusted.

How Parameters are Organized

Inverter parameters are organized into seven files:

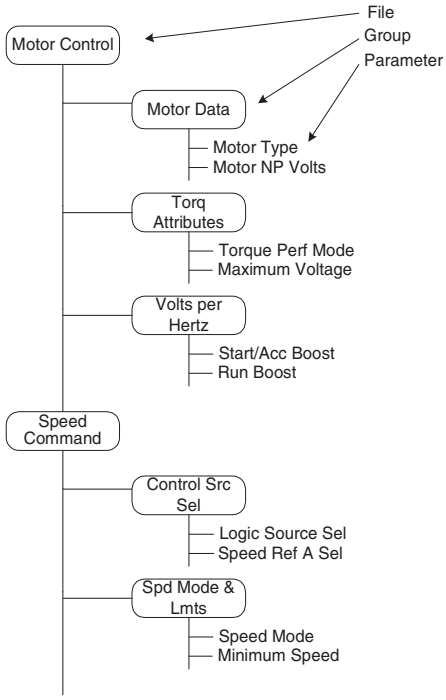
- Monitor
- Motor Control
- Speed Command
- Dynamic Control
- Utility
- Communication
- Inputs and Outputs

Rectifier parameters are organized into seven files:

- Monitor
- Configuration
- Dynamic Control
- Internal Data
- Utility
- Communication
- Inputs and Outputs

Each file contains parameters that are grouped by their function. A file can contain several groups of parameters. See Figure 25.

Figure 25 - Example of Parameter Organization



Inverter Parameters View

The table below shows the inverter parameters organized by their respective files and groups.

File	Group	Parameters					
Monitor	Metering	Output Freq	1	Output Powr Fctr	8	Analog In2 Value	17
		Commanded Freq	2	Elapsed MWh	9	Analog In3 Value	18
		Output Current	3	Elapsed Run Time	10	Ground Current	21
		Torque Current	4	MOP Frequency	11	Phase U Current	22
		Flux Current	5	DC Bus Voltage	12	Phase V Current	23
		Output Voltage	6	DC Bus Memory	13	Phase W Current	24
		Output Power	7	Analog In1 Value	16	Est Input Power	25
	Drive Data	Rated kW	26	Rated Amps	28	–	
		Rated Volts	27	Control SW Ver	29	–	
	Application	Appl Digital Out	30	Rctfr Config	32	Rctfr Status	34
		Appl Analog Out	31	Rctfr Control	33	Rctfr Fault	35
Motor Control	Motor Data	Motor Type	40	Motor NP RPM	44	Motor OL Amps	48
		Motor NP Volts	41	Motor NP Power	45	Imbalance Limit	49
		Motor NP FLA	42	Mtr NP Pwr Units	46	Imbalance Time	50
		Motor NP Hertz	43	Motor OL Hertz	47	–	
	Torq Attributes	Torque Perf Mode	53	Flux Up Mode	57	IR Voltage Drop	62
		Maximum Voltage	54	Flux Up Time	58	Flux Current Ref	63
		Maximum Freq	55	SV Boost Filter	59	Ixo Voltage Drop	64
		Compensation	56	Autotune	61	–	
	Volts per Hertz	Start/Acc Boost	69	Break Voltage	71	–	
		Run Boost	70	Break Frequency	72	–	
Speed Command	Spd Mode & Limits	Speed Mode	80	Overspeed Limit	83	Skip Frequency 3	86
		Minimum Speed	81	Skip Frequency 1	84	Skip Freq Band	87
		Maximum Speed	82	Skip Frequency 2	85	–	
	Speed References	Speed Ref A Sel	90	Speed Ref B Sel	93	TB Man Ref Sel	96
		Speed Ref A Hi	91	Speed Ref B Hi	94	TB Man Ref Hi	97
		Speed Ref A Lo	92	Speed Ref B Lo	95	TB Man Ref Lo	98
	Discrete Speeds	Jog Speed	100	Preset Speed 1...7	101... 107	–	
	Speed Trim	Trim In Select	117	Trim Hi	119	–	
		Trim Out Select	118	Trim Lo	120	–	
	Slip Comp	Slip RPM @ FLA	121	Slip Comp Gain	122	Slip RPM Meter	123
	Process PI	PI Configuration	124	PI Integral Time	129	PI Status	134
		PI Control	125	PI Prop Gain	130	PI Ref Meter	135
		PI Reference Sel	126	PI Lower Limit	131	PI Fdback Meter	136
		PI Setpoint	127	PI Upper Limit	132	PI Error Meter	137
		PI Feedback Sel	128	PI Preload	133	PI Output Meter	138

File	Group	Parameters					
Dynamic Control	Ramp Rates	Accel Time 1	140	Decel Time 1	142	S Curve %	146
		Accel Time 2	141	Decel Time 2	143	–	
	Load Limits	Current Lmt Sel	147	Current Lmt Gain	149	PWM Frequency	151
		Current Lmt Val	148	Drive OL Mode	150	–	
	Stop/Brake Modes	Stop Mode A	155	DC Brake Time	159	DB Resistor Type	163
		Stop Mode B	156	Bus Reg Ki	160	Bus Reg Kp	164
		DC Brake Lvl Sel	157	Bus Reg Mode A	161	Bus Reg Kd	165
		DC Brake Level	158	Bus Reg Mode B	162	–	
	Stop/Restart Modes	Start At PowerUp	168	Flying Start En	169	–	
	Restart Modes	Flying Start Gain	170	Sleep-Wake Mode	178	Wake Time	181
		Auto Rstrt Tries	174	Sleep-Wake Ref	179	Sleep Level	182
		Auto Rstrt Delay	175	Wake Level	180	Sleep Time	183
	Power Loss	Power Loss Mode	184	Power Loss Time	185	Power Loss Level	186
Utility	Direction Config	Direction Mode	190	–	–	–	
	HIM Ref Config	Save HIM Ref	192	Man Ref Preload	193	–	
	MOP Config	Save MOP Ref	194	MOP Rate	195	–	
	Drive Memory	Param Access Lvl	196	Save To User Set	199	Voltage Class	202
		Reset To Defalts	197	Reset Meters	200	Drive Checksum	203
		Load Frm Usr Set	198	Language	201	–	
	Diagnostics	Drive Status 1	209	Dig Out Status	217	Status 1 @ Fault	227
		Drive Status 2	210	Invtr Base Temp	218	Status 2 @ Fault	228
		Drive Alarm 1	211	Drive OL Count	219	Alarm 1 @ Fault	229
		Drive Alarm 2	212	Motor OL Count	220	Alarm 2 @ Fault	230
		Speed Ref Source	213	Imbalance Count	221	Testpoint 1 Sel	234
		Start Inhibits	214	Fault Frequency	224	Testpoint 1 Data	235
		Last Stop Source	215	Fault Amps	225	Testpoint 2 Sel	236
		Dig In Status	216	Fault Bus Volts	226	Testpoint 2 Data	237
	Faults	Fault Config 1	238	Fault Clear Mode	241	–	
		Fault Clear	240	Power Up Marker	242	–	
		Fault 1 Code... Fault 8 Code	243 245 247 249 251 253 255 257	Fault 1 Time... Fault 8 Time	244 246 248 250 252 254 256 258	–	
	Alarms	Alarm Config 1	259	Alarm Clear	261	Alarm 1 Code... Alarm 8 Code	262... 269
		Drive Alarm 1	211	Drive Alarm 2	212	–	

File	Group	Parameters					
Communication	Comm Control	DPI Data Rate	270	Drive Ref Rslt	272	–	
		Drive Logic Rslt	271	Drive Ramp Rslt	273	–	
	Masks & Owners	Logic Mask	276	Fault Clr Mask	283	Reference Owner	292
		Start Mask	277	MOP Mask	284	Accel Owner	293
		Jog Mask	278	Local Mask	285	Decel Owner	294
		Direction Mask	279	Stop Owner	288	Fault Clr Owner	295
		Reference Mask	280	Start Owner	289	MOP Owner	296
		Accel Mask	281	Jog Owner	290	Local Owner	297
		Decel Mask	282	Direction Owner	291	–	
	Datalinks	Data In A1 - Link A Word 1	300	Data In D 1 - Link D Word 1	306	Data Out C 1 - Link C Word 1	314
		Data In A2 - Link A Word 2	301	Data In D 2 - Link D Word 2	307	Data Out C 2 - Link C Word 2	315
		Data In B 1 - Link B Word 1	302	Data Out A1 - Link A Word 1	310	Data Out D 1 - Link D Word 1	316
		Data In B 2 - Link B Word 2	303	Data Out A2 - Link A Word 2	311	Data Out D 2 - Link D Word 2	317
		Data In C 1 - Link C Word 1	304	Data Out B 1 - Link B Word 1	312	–	
		Data In C 2 - Link C Word 2	305	Data Out B 2 - Link B Word 2	313	–	
Inputs & Outputs	Analog Inputs	Anlg In Config	320	Analog In 1 Lo	323	Analog In 2 Lo	326
		Anlg In Sqr Root	321	Analog In 1 Loss	324	Analog In 2 Loss	327
		Analog In 1 Hi	322	Analog In 2 Hi	325	–	
	Analog Outputs	Anlg Out Config	340	Analog Out1 Sel	342	Analog Out1 Lo	344
		Anlg Out Absolut	341	Analog Out1 Hi	343	–	
	Temperature etc	Inv IGBT Tmp Top	345	Inv Coldplt Tmp	349	Inv PS -12	353
		Inv IGBT Tmp Up	346	Inv Ambient Tmp	350	Inv I/O ID V	354
		Inv IGBT TMP Low	347	Inv PS Tmp	351	–	
		Inv IGBT Tmp Bot	348	Inv PS +12	352	–	
	Digital Inputs	Digital In1 Sel... Digital In6 Sel	361... 366	–		–	
	Digital Outputs	Digital Out1 Sel	380	Dig Out1 OffTime	383	Dig Out2 OnTime	386
		Dig Out1 Level	381	Digital Out2 Sel	384	Dig Out2 OffTime	387
		Dig Out1 OnTime	382	Dig Out2 Level	385	–	

Rectifier Parameters View

The table below shows the rectifier parameters organized by their respective files and groups.

File	Group	Parameters					
Monitor	Metering	Line Frequency	1	Input Voltage TR	9	Elapsed Run Time	17
		Input Current R	2	DC Bus Voltage	10	Rctfr Base Temp	18
		Input Current S	3	Active Voltage	11	Rctfr IGBT Temp	19
		Input Current T	4	Reactive Voltage	12	Rctfr IT Overld	20
		Active Current	5	Input kW	13	Rctfr I2T Overld	21
		Reactive Current	6	Input Pwr Factor	14	Line I Imbalance	22
		Input Voltage RS	7	Motoring kWh	15	Line V Imbalance	23
		Input Voltage ST	8	Regen kWh	16	–	
	Drive Data	Rated kW	26	Rated Amps	28	–	
		Rated Volts	27	Control SW Ver	29	–	
Configuration	AC Line	V Imbalance Lmt	60	I Imbalance Lmt	62	Ride Through Ena	64
		V Imbalance Time	61	I Imbalance Time	63	Ride Through Sec	65
Dynamic Control	Control and Status	Rectifier Contrl	100	Rectifier Status	101	–	
	Bus Voltage	Vdc Optimize	102	Vdc Reference	103	Vdc Command	104
	Load Limits	Current Limit	105	Max Motor Volts	107	Base Motor Freq	109
		Input Load Amps	106	Max Motor Freq	108	–	
	Regulator Tuning	VML Ki	110	CML Ki	112	VML Reset Level	114
		VML Kp	111	CML Kp	113	–	
	Cold Plate	Cold Plate Temp	120	CPC K2	124	Delay After Move	128
		Invtr Base Temp	121	High Temp Limit	125	Ambient Temp	129
		Rctfr Base Temp	122	Low Temp Limit	126	–	
		CPC K1	123	Start Move Time	127	–	
Internal Data	Normalized Amps	Input Load Amps	150	Current Limit	151	–	
	Total Elapsed	Life KW H	152	Life Power Time	154	–	
		Life Run Time	153	Life Power Cycle	155	–	
	DPI Counters	DPI Error	156	CS Timeout Cnt	159	PC MSG Tx Cnt	162
		CS Msg Rx Cnt	157	CS MSG Bad Cnt	160	PC Timeout Cnt	163
		CS Msg Tx Cnt	158	PC MSG Rx Cnt	161	CAN Bus Off Cnt	164
	D/A Output Sel	D/A Select (N)	171... 174	–		–	

File	Group	Parameters					
Utility	Drive Memory	Param Access Lvl	196	Save to User Set	199	Drive Checksum	203
		Reset to Defaults	197	Reset Meters	200	–	
		Load Frm Usr Set	198	Language	201	–	
	Status	Drive Alarm	211	Dig In Status	216	–	
		Start Inhibits	214	Dig Out Status	217	–	
	Diagnostics	Fault Frequency	220	Fault Amps D	225	Testpoint 1 Data	235
		Fault Amps R	221	Fault Volts Vdc	226	Testpoint 2 Sel	236
		Fault Amps S	222	Fault Volts Q	227	Testpoint 2 Data	237
		Fault Amps T	223	Fault Volts D	228	–	
		Fault Amps Q	224	Testpoint 1 Sel	234	–	
	Fault Queue	Fault Config	238	Fault To Invertr	241	Fault 1 Code... Fault 4 Code	243 245 247 249
		Fault Clear	240	Power Up Marker	242	Fault 1 Time... Fault 4 Time	244 246 248 250
Communications	In Data Links	IOC Redir Time	300	Service 302	302	–	
		IOC Redir Max	301	Service 303	303	–	
Inputs & Outputs	Temperatures etc	Rct IGBT Tmp Top	345	Rct Coldplt Tmp	349	Rct PS -12V	353
		Rct IGBT Tmp Up	346	Rct Ambient Tmp	350	Rct I/O ID V	354
		Rct IGBT Tmp Low	347	Rct PS Tmp	351	–	
		Rct IGBT Tmp Bot	348	Rct PS +12V	352	–	

Accessing the Parameters

Parameters are programmed and viewed using the OIM or VS Utilities software.

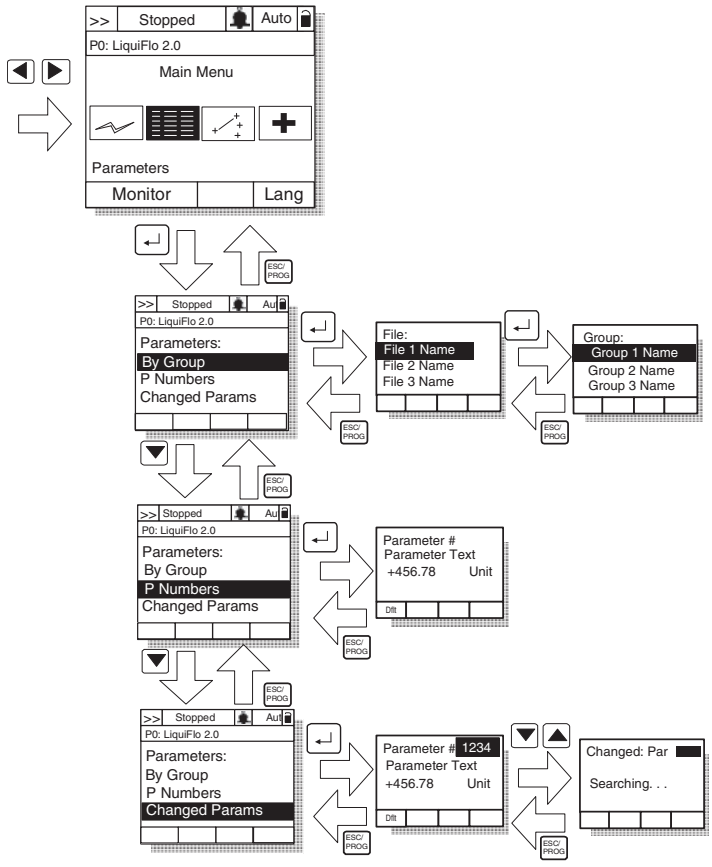
The OIM displays parameters by group, by individual parameter number, and parameters that have changed from their default value.

To access parameters using the OIM, select the Parameters icon from the main screen. See Figure 26.

See Appendix B for information on modifying parameters using the OIM.

Refer to the VS Utilities Getting Results Manual, publication D2-3488, for information on accessing and modifying parameters using VS Utilities software.

Figure 26 - Accessing the Parameters Using the OIM

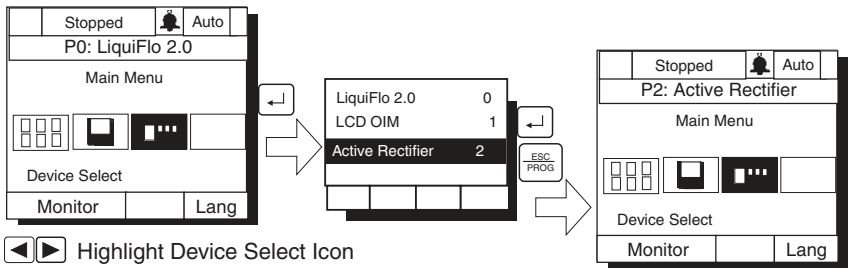


Viewing Rectifier or Inverter Parameters

The OIM initially displays information about the inverter, including inverter parameters.

To display rectifier parameters and other information about the rectifier, switch the OIM to the Active Rectifier device. See Figure 27.

Figure 27 - Selecting the Active Rectifier



To switch back to viewing inverter information, use the process described by Figure 27, but select the **LiquiFlo 2.0** device.

Selecting the Parameter Access Level

The LiquiFlo 2.0 AC drive provides two levels of access to the parameters:

- Basic (0)
- Advanced (1)

The Advanced level allows access to all of the parameters.

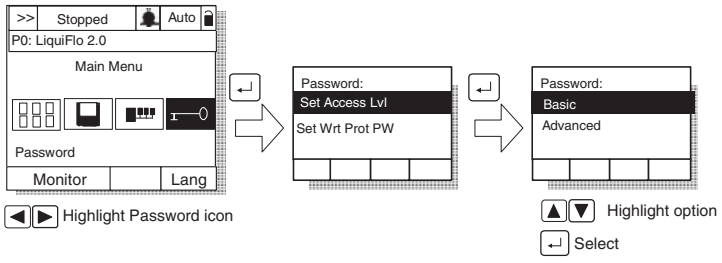
The Basic level allows access to a subset of the Standard level and contains only the most commonly used parameters. See Inverter Parameters Basic Access Level on page 64 and Rectifier Parameters Basic Access Level on page 64 for parameters available at the Basic level.

The active access level is displayed in Parameter Access Level (196).

To select the parameter access level using the OIM, select the Password icon from the main menu. See Figure 28.

IMPORTANT This option is not supported in the VS Utilities software.

Figure 28 - Selecting the Parameter Access Level



Inverter Parameters Basic Access Level

The inverter parameters available at the Basic level (0) are listed in the table below.

1	Output Freq	97	TB Man Ref Hi	190	Direction Mode
2	Commanded Freq	98	TB Man Ref Lo	196	Param Access Lvl
3	Output Current	100	Jog Speed	197	Reset To Defalts
12	DC Bus Voltage	101... 107	Preset Speed 1...7	198	Load Frm Usr Set
41	Motor NP Volts	140	Accel Time 1	199	Save To User Set
42	Motor NP FLA	141	Accel Time 2	201	Language
43	Motor NP Hertz	142	Decel Time 1	214	Start Inhibits
44	Motor NP RPM	143	Decel Time 2	216	Dig In Status
45	Motor NP Power	146	S Curve %	217	Dig Out Status
46	Mtr NP Pwr Units	147	Current Lmt Sel	238	Fault Config 1
47	Motor OL Hertz	148	Current Lmt Val	320	Anlg In Config
53	Torque Perf Mode	155	Stop Mode A	322	Analog In 1 Hi
54	Maximum Voltage	156	Stop Mode B	323	Analog In 1 Lo
55	Maximum Freq	157	DC Brake Lvl Sel	325	Analog In 2 Hi
61	Autotune	158	DC Brake Level	326	Analog In 2 Lo
81	Minimum Speed	159	DC Brake Time	342	Analog Out1 Sel
82	Maximum Speed	161	Bus Reg Mode A	343	Analog Out1 Hi
90	Speed Ref A Sel	162	Bus Reg Mode B	344	Analog Out1 Lo
91	Speed Ref A Hi	163	DB Resistor Type	361... 366	Digital In1 Sel... Digital In6 Sel
92	Speed Ref A Lo	168	Start At PowerUp	380	Digital Out1 Sel
93	Speed Ref B Sel	174	Auto Rstrt Tries	381	Dig Out1 Level
94	Speed Ref B Hi	175	Auto Rstrt Delay	384	Digital Out2 Sel
95	Speed Ref B Lo	184	Power Loss Mode	385	Dig Out2 Level
96	TB Man Ref Sel	185	Power Loss Time		–

Rectifier Parameters Basic Access Level

The rectifier parameters available at the Basic level (0) are listed in the table below.

1	Line Frequency	103	Vdc Reference	164	CAN Bus Off Cnt
2	Input Current R	104	Vdc Command	171... 174	D/A Select (N)
3	Input Current S	105	Current Limit	196	Param Access Lvl
4	Input Current T	106	Input Load Amps	197	Reset to Defalts
5	Active Current	107	Max Motor Volts	198	Load Frm Usr Set
6	Reactive Current	108	Max Motor Freq	199	Save to User Set

7	Input Voltage RS	109	Base Motor Freq	200	Reset Meters
8	Input Voltage ST	110	VML Ki	201	Language
9	Input Voltage TR	111	VML Kp	203	Drive Checksum
10	DC Bus Voltage	112	CML Ki	211	Drive Alarm
11	Active Voltage	113	CML Kp	214	Start Inhibits
12	Reactive Voltage	114	VML Reset Level	216	Dig In Status
13	Input kW	120	Cold Plate Temp	217	Dig Out Status
14	Input Pwr Factor	121	Invtr Base Temp	220	Fault Frequency
15	Motoring kWh	122	Rctfr Base Temp	221	Fault Amps R
16	Regen kWh	123	CPC K1	222	Fault Amps S
17	Elapsed Run Time	124	CPC K2	223	Fault Amps T
18	Rctfr Base Temp	125	High Temp Limit	224	Fault Amps Q
19	Rctfr IGBT Temp	126	Low Temp Limit	225	Fault Amps D
20	Rctfr IT Overld	127	Start Move Time	226	Fault Volts Vdc
21	Rctfr I2T Overld	128	Delay After Move	227	Fault Volts Q
22	Line I Imbalance	129	Ambient Temp	228	Fault Volts D
23	Line V Imbalance	150	Input Load Amps	234	Testpoint 1 Sel
26	Rated kW	151	Current Limit	235	Testpoint 1 Data
27	Rated Volts	152	Life KW H	236	Testpoint 2 Sel
28	Rated Amps	153	Life Run Time	237	Testpoint 2 Data
29	Control SW Ver	154	Life Power Time	238	Fault Config
60	V Imbalance Lmt	155	Life Power Cycle	240	Fault Clear
61	V Imbalance Time	156	DPI Error	241	Fault To Invertr
62	I Imbalance Lmt	157	CS Msg Rx Cnt	242	Power Up Marker
63	I Imbalance Time	158	CS Msg Tx Cnt	243 245 247 249	Fault 1 Code... Fault 4 Code
64	Ride Through Ena	159	CS Timeout Cnt	244 246 248 250	Fault 1 Time... Fault 4 Time
65	Ride Through Sec	160	CS MSG Bad Cnt	300	IOC Redir Time
100	Rectifier Contrl	161	PC MSG Rx Cnt	301	IOC Redir Max
101	Rectifier Status	162	PC MSG Tx Cnt	302	Service 302
102	Vdc Optimize	163	PC Timeout Cnt	303	Service 303

Security and Passwords

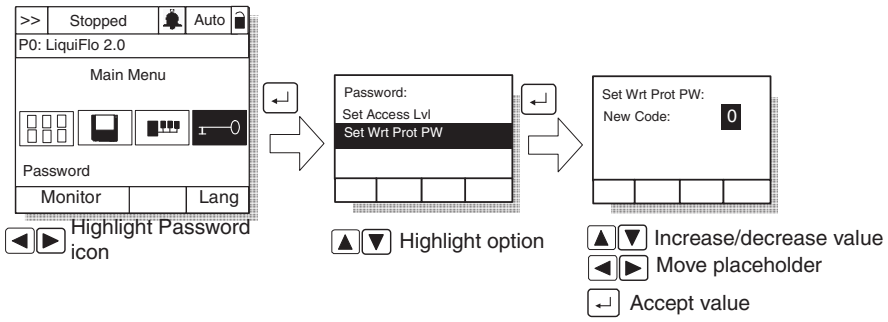
ATTENTION: It is your responsibility to determine how to distribute the write-protect password. Rockwell Automation is not responsible for unauthorized access violations within your organization. Failure to observe this precaution could result in bodily injury.

Parameter values can be password-protected using the OIM. When the password is enabled, parameter values can be displayed. However, if there is an attempt to change a parameter value, a password pop-up box appears on the OIM screen to prompt for the user-defined write-protect password.

To set the write-protect password, select the Password icon from the main menu. See Figure 29. The password value can range from 1...9999. A value of 0 disables the password (factory default). To disable the password, you must first enter the correct value and then set the password to zero.

When the password is enabled, the lock symbol on the screen changes from 🔓 to 🔒.

Figure 29 - Setting the Write-protect Password



When you enter the password, you can adjust parameters until you select Logout or return to the process display screen, which re-activates the password. See Monitoring the Drive Using the Process Display Screen on the OIM on page 242 for information about the process display screen.

IMPORTANT This option is not supported in the VS Utilities software.

If There is More Than One OIM Connected to the Drive

IMPORTANT Setting the write-protect password value to zero on one OIM disables the write-protect password on all connected OIMs.

Setting the write-protect password in one OIM does not affect any other OIM connected to the drive unless a write-protect password has also been set in the other OIMs. In this case, the last password value entered becomes the password value for all password-protected OIMs. (Each OIM cannot have a different password value.)

For example, if the write-protect password has been set to 5555 for the local OIM, someone using a remote OIM with no write-protect password set can still program all of the parameters. If the write-protect password is then set to 6666 on the remote OIM, you are required to enter 6666 on the local OIM to program the parameters.

Notes:

Parameter Descriptions

The following information is provided for each parameter along with its description:

Parameter Number:	Unique number assigned to each parameter.
Parameter Name:	Unique name assigned to each parameter.
Range:	Predefined parameter limits or selections. Note that a negative Hz value indicates reverse rotation.
Default:	Factory default setting.
Access:	Parameter access level. • **0** = Basic (reduced parameter set, most commonly used) • **1** = Advanced (full parameter set)
Path:	Menu selections to reach specified parameter. The path is indicated in this manner: File > Group
See also:	Associated parameters that may provide additional or related information.

What the Symbols Mean

Symbol	Meaning
	32-bit parameter
	Drive must be stopped before changing parameter value.

Parameter Organization

The parameters in this chapter are presented in numerical order. To view the parameters organized by their file and group structure, see:

- Inverter Parameters View on page 57
- Rectifier Parameters View on page 60

Inverter Parameters

1 Output Freq

Range:	+/-400.0 Hz [0.1 Hz]
Default:	Read Only
Access:	0 **Path**: Monitor > Metering
See also:	

The output frequency present at T1, T2, and T3 (U, V, and W).

2 Commanded Freq

Range:	+/- 400.0 Hz [0.1 Hz]
Default:	Read Only
Access:	0 **Path:** Monitor > Metering
See also:	

The value of the active frequency command.

3 Output Current

Range:	0.0...3276.7 A [0.1 A]
Default:	Read Only
Access:	0 **Path:** Monitor > Metering
See also:	

The total RMS output current present at T1, T2, and T3 (U, V, and W).

4 Torque Current

Range:	+/- 1800.0 A [0.1 A]
Default:	Read Only
Access:	1 **Path:** Monitor > Metering
See also:	

The amount of output current that is in phase with the fundamental voltage component.

5 Flux Current

Range:	+/- 1800.0 A [0.1 A]
Default:	Read Only
Access:	1 **Path:** Monitor > Metering
See also:	

The amount of output current that is out of phase with the fundamental voltage component.

6 Output Voltage

Range: 0.0...600.0V AC [0.1V AC]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The RMS output voltage present at terminals T1, T2, and T3 (U, V, and W).

7 Output Power

Range: 0...2400.0 kW [0.1 kW]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The output power present at T1, T2, and T3 (U, V, and W).

8 Output Powr Fctr

Range: 0.00...1.00 [0.01]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The output power factor.

9 Elapsed MWh

32

Range: 0.0...429,496,729.5 MWh [0.1 MWh]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The accumulated output energy of the drive.

10 Elapsed Run Time

32

Range: 0.0...429,496,729.5 Hr [0.1 Hr]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The accumulated time the drive has been outputting power.

11 MOP Frequency

Range: +/- 400.0 [0.1 Hz]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The current value of the Motor Operated Potentiometer (MOP) output frequency value maintained internal to the drive firmware.

12 DC Bus Voltage

Range: 0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The present DC bus voltage level.

13 DC Bus Memory

Range: 0...819.2V DC [0.1V DC]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

When AC line voltage is present and the drive is synchronized to the AC line voltage waveform, this parameter contains the present DC bus voltage level. When the drive is not synchronized to the AC line voltage waveform (for example, when the AC line voltage is not present), this parameter contains a 6-minute average of the DC bus voltage level.

16 Analog In1 Value
17 Analog In2 Value
18 Analog In3 Value

Range: 0.000...20.000 mA [0.001 mA]
-/+10.000V [0.001V]
Default: Read Only
Access: 1 **Path:** Monitor > Metering
See also:

The value of the signal of a user-configurable analog input. See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Analog In3 Value (18) is not usable on LiquiFlo 2.0 drives, and is only provided for compatibility with other drive models. Analog In3 Value (18) is present on Frame 3 drives only.

21 Ground Current

Range:	0.0...3276.7 [0.1 A]		
Default:	Read Only		
Access:	1	**Path:**	Monitor > Metering
See also:			

The analog value of motor ground current. Ground current trip is at about 50% of drive rated current.

22 Phase U Current
23 Phase V Current
24 Phase W Current

Range:	0.0...3276.7 [0.1 A]		
Default:	Read Only		
Access:	1	**Path:**	Monitor > Metering
See also:			

The RMS motor output current value, as follows:

- Parameter 22 displays the phase U RMS current value.
- Parameter 23 displays the phase V RMS current value.
- Parameter 24 displays the phase W RMS current value.

25 Est Input Power

Range:	0.0...3000.0 [0.1 kW]		
Default:	Read Only		
Access:	1	**Path:**	Monitor > Metering
See also:	7		

The estimated input power of the drive. This value is calculated as a function of the output power.

26 Rated kW

32

Range:	0.00...3000.00 kW [0.01 kW]		
Default:	Read Only		
Access:	1	**Path:**	Monitor > Drive Data
See also:			

The drive power rating.

27 Rated Volts

Range: 480V [0.1V AC]
Default: Read Only
Access: 1 **Path:** Monitor > Drive Data
See also:

The drive output voltage class.

28 Rated Amps

Range: 0.0...6553.5 Amps [0.1 A]
Default: Read Only
Access: 1 **Path:** Monitor > Drive Data
See also:

The drive rated RMS output current.

29 Control SW Ver

Range: 0.000...65.256 [0.001]
Default: Read Only
Access: 1 **Path:** Monitor > Drive Data
See also: 196

The Main Control board software version.

30 Appl Digital Out

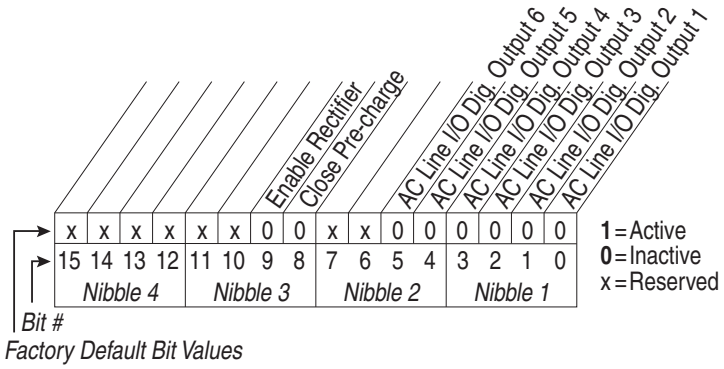
Range: See Figure 30 and Figure 31
Default: See Figure 30 and Figure 31
Access: 1 **Path:** Monitor > Application
See also:

Frame 3 drives (firmware version 1.x) only:

The lower byte of this parameter controls the state of the application digital outputs on the AC Line I/O card. The upper byte controls the operation of the rectifier when configured for manual operation.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Figure 30 - Appl Digital Output (30) Frame 3

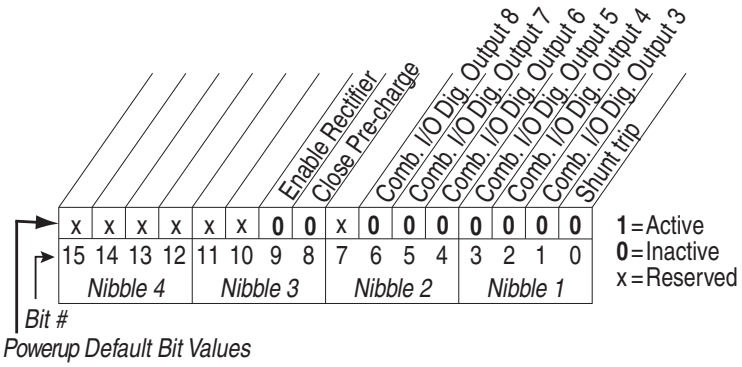

Enable Rectifier
Close Pre-charge
AC Line I/O Dig. Output 6
AC Line I/O Dig. Output 5
AC Line I/O Dig. Output 4
AC Line I/O Dig. Output 3
AC Line I/O Dig. Output 2
AC Line I/O Dig. Output 1
x x x x x x 0 0 x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Active
0 = Inactive
x = Reserved

Factory Default Bit Values

Frame 4 drives (firmware version 2.x) only:

The lower byte of this parameter controls the state of the shunt trip digital output and the six application controlled digital outputs on the Combined I/O board. The upper byte controls the operation of the rectifier when configured for manual operation.

Figure 31 - Appl Digital Output (30) Frame 4


Enable Rectifier
Close Pre-charge
Comb. I/O Dig. Output 8
Comb. I/O Dig. Output 7
Comb. I/O Dig. Output 6
Comb. I/O Dig. Output 5
Comb. I/O Dig. Output 4
Comb. I/O Dig. Output 3
Shunt trip
x x x x x x 0 0 x 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Active
0 = Inactive
x = Reserved

Powerup Default Bit Values

In addition to controlling digital output 3, bit 1 is also used to force the **Aux Run** digital output condition to true. This only occurs if the Digital Out Sel parameter for one of the user-configurable digital outputs is set to **Aux Run**.

31 Appl Analog Out

Range:	-32.767...32.767 [0.001 mA, or 0.001V (frame 4 only)]
Default:	See Table 6 below.
Access:	1 **Path:** Monitor > Application
See also:	342, 343, 344

The value entered into this parameter is output on the analog output when it is configured for **Application** control. See parameter Analog Out1 Sel (342).

The usable range and default for this parameter depends on the operational mode of the analog output, which in turn depends both on the capabilities of the analog output hardware and the current value of parameter Analog Out Config (340). Table 6 describes the details for usable range and default.

Table 6 - Appl Analog Output (31) usable range and default

Mode	Usable Range	Default
0...10V (unipolar)	0.000...10.000V	0.000V
-10...10V (bipolar)	-10.000...10.000V	0.000V
4...20 mA	0.000...20.000 mA	0.000 mA

The value in the **Default** column of Table 6 is in effect when the drive powers up. This parameter value is not stored in non-volatile memory.

For frame 3 drives (firmware version 1.x), the user-configurable analog output hardware is located on the optional Standard I/O Board. This parameter is not usable if the optional Standard I/O Board is not present. See Standard I/O Board Description (Frame 3 Only) on page 27 for terminal block assignments.

For frame 4 drives (firmware version 2.x), the user-configurable analog output hardware is located on the Combined I/O Board. See Combined I/O Board Description (Frame 4 Only) on page 29 for terminal block assignments.

32 Rctfr Config

Range: 0 = Run at Start
1 = Run at Power Up
2 = Manual Control
3 = Diode Rectifier

Default: 0

Access: 1 **Path:** Monitor > Application

See also: 30

Selects how rectifier sequencing operates.

0 = The precharge is closed and voltage regulation is enabled when the inverter is requested to start.

1 = The precharge is closed and voltage regulation is enabled when power is turned on.

2 = The closing of the precharge and enabling of voltage regulation is controlled by some other device writing into inverter Appl Digital Out (30).

3 = Rectifier consists of a diode bridge. This mode is for engineering use only.

33 Rctfr Control

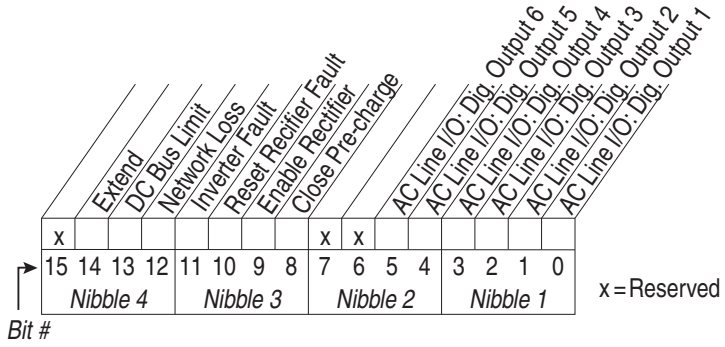
Range:	See Figure 32 and Figure 33
Default:	N/A
Access:	1 **Path:** Monitor > Application
See also:	30, 32, rectifier 100

The commanded state of the rectifier.

IMPORTANT This parameter is used for communication between the inverter and the rectifier. Do not write to this parameter using VS Utilities, DriveExplorer, or an OIM. Its value changes according to the operational state of the drive.

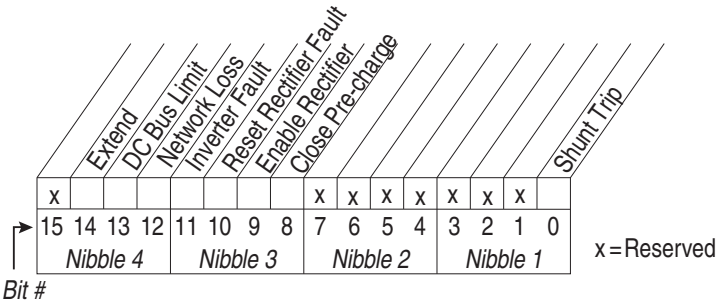
Frame 3 drives (firmware version 1.x) only:

Figure 32 - Rectifier Control (33) Frame 3


Extend
DC Bus Limit
Network Loss
Inverter Fault
Reset Rectifier Fault
Enable Rectifier
Close Pre-charge
AC Line I/O: Dig. Output 6
AC Line I/O: Dig. Output 5
AC Line I/O: Dig. Output 4
AC Line I/O: Dig. Output 3
AC Line I/O: Dig. Output 2
AC Line I/O: Dig. Output 1
x x x
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
x = Reserved

Frame 4 drives (firmware version 2.x) only:

Figure 33 - Rectifier Control (33) Frame 4



34 Rctfr Status

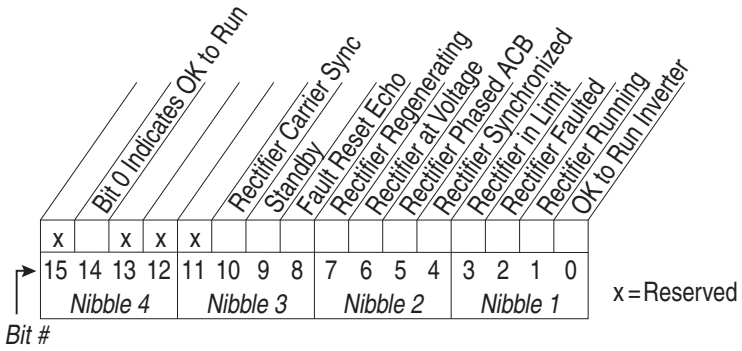
Range:	See Figure 34 and Figure 35
Default:	N/A
Access:	1 **Path:** Monitor > Application
See also:	rectifier 101

The actual state of the rectifier.

IMPORTANT This parameter is used for communication between the inverter and the rectifier. Do not write to this parameter using VS Utilities, DriveExplorer, or an OIM. Its value changes according to the operational state of the drive.

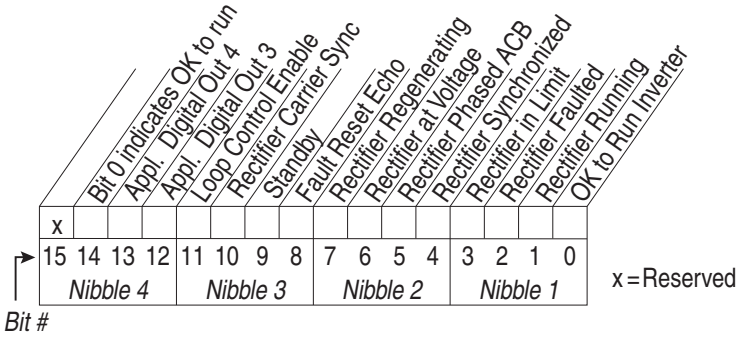
Frame 3 drives (firmware version 1.x) only:

Figure 34 - Rectifier Status (34) Frame 3



Frame 4 drives (firmware version 2.x) only:

Figure 35 - Rectifier Status (34) Frame 4



35 Rctfr Fault

Range:	0...299		
Default:	Read Only		
Access:	1	**Path:**	Monitor > Application
See also:			

Displays a fault from the rectifier. The rectifier writes a fault code into this parameter through a data link.

40 Motor Type

Range:	0 = Induction 1 = Synchr Reluc 2 = Synchr PM		
Default:	0 = Induction		
Access:	1	**Path:**	Motor Control > Motor Data
See also:			

Set to match the type of motor connected: Induction, Synchronous Reluctance, or Synchronous Permanent Magnet.

41 Motor NP Volts

Range:	0.0 to Drive Rated Volts [0.1V AC]		
Default:	Based on Drive Type		
Access:	0	**Path:**	Motor Control > Motor Data
See also:			

Set to the motor nameplate rated volts. The motor nameplate base voltage defines the output voltage when operating at rated current, rated speed, and rated temperature.

42 Motor NP FLA

Range:	0.0 to Rated Amps x 2 [0.1 A]		
Default:	Based on Drive Type		
Access:	0	**Path:**	Motor Control > Motor Data
See also:	47, 48		

Set to the motor nameplate rated full load amps. The motor nameplate FLA defines the output amps when operating at rated voltage, rated speed, and rated temperature. It is used in the motor thermal overload and in the calculation of slip.

43 Motor NP Hertz

Range: 5.0...250.0 Hz [0.1 Hz]
Default: Based on Drive Type
Access: 0 **Path:** Motor Control > Motor Data
See also:

Set to the motor nameplate rated frequency. The motor nameplate base frequency defines the output frequency when operating at rated voltage, rated current, rated speed, and rated temperature.

44 Motor NP RPM

Range: 60...24000 RPM [1 RPM]
Default: 1780 RPM
Access: 0 **Path:** Motor Control > Motor Data
See also:

Set to the motor nameplate rated RPM. The motor nameplate RPM defines the rated speed when operating at motor nameplate base frequency, rated current, base voltage, and rated temperature. This is used to calculate slip.

45 Motor NP Power

Range: 0.00...3000.00 [0.01 kW or 0.01 HP]
Default: Based on Drive Type
Access: 0 **Path:** Motor Control > Motor Data
See also: 46

Set to the motor nameplate rated power. The motor nameplate power is used with the other nameplate values to calculate default values for motor parameters to assist the commissioning process. This is entered in horsepower or in kilowatts as selected in parameter 46.

46 Mtr NP Pwr Units

Range: 0 = Horsepower
1 = kilowatts
Default: Based on Drive Type
Access: 0 **Path:** Motor Control > Motor Data
See also:

Set to the power units shown on the motor nameplate. This parameter determines the units for parameter 45.

47 Motor OL Hertz

Range:	0.0...400.0 Hz [0.1 Hz]
Default:	0
Access:	0 **Path:** Motor Control > Motor Data
See also:	42, 48, 220

Selects the output frequency below which the motor operating current is derated. The motor thermal overload then generates a fault at lower levels of current. For all settings of overload Hz other than zero, the overload capacity is reduced to 70% when output frequency is zero.

48 Motor OL Amps

Range:	1.0...2000.0 [0.1 A]
Default:	Based on Drive Type
Access:	1 **Path:** Motor Control > Motor Data
See also:	42, 47, 220

Sets the RMS amps threshold for motor overload fault. In order for the motor overload fault (48) to occur, it must be enabled using inverter parameter Fault Config 1 (238).

The drive output current is visible in inverter parameter Output Current (3).

The motor overload fault occurs under these conditions:

- If the drive output (motor) current is **138%** of Motor OL Amps, the fault occurs at 1.5 seconds.
- If the drive output (motor) current is **greater than 138%** of Motor OL Amps, the fault occurs in less than 1.5 seconds.
- If the drive output (motor) current is **between 102% and 138%** of Motor OL Amps, the fault occurs in greater than 1.5 seconds.
- If the drive output (motor) current is **less than 102%** of Motor OL Amps, the fault does not occur.

Motor overload fault percent trip is visible in inverter parameter Motor OL Count (220). The fault occurs when this parameter reaches 100%. This parameter does not increase unless the drive output current is greater than 102% of Motor OL Amps.

49 Imbalance Limit

Range: 0.0...40.0 [0.1%]
Default: 10.0
Access: 1 **Path:** Motor Control > Motor Data
See also: 50, 221

Sets the fault threshold for motor current imbalance.

If inverter Imbalance Count (221) exceeds inverter Imbalance Limit (49) for longer than the time in inverter Imbalance Time (50), the drive faults with the Motor I Imbalance fault (fault 37).

50 Imbalance Time

Range: 1.0...10.0 [0.1 sec]
Default: 5.0
Access: 1 **Path:** Motor Control > Motor Data
See also: 49, 221

Sets the time delay in generating a motor current imbalance fault.

If inverter Imbalance Count (221) exceeds inverter Imbalance Limit (49) for longer than the time in inverter Imbalance Time (50), the drive faults with the Motor I Imbalance fault (fault 37).

Also sets the time delay in generating a Current Feedback Lost Fault (fault 35). If this parameter is set to exactly 10.0 seconds, then the Current Feedback Lost Fault does not occur.

53 Torque Perf Mode

Range: 0 = Sensrls Vect
1 = SV Economize
2 = Custom V/Hz
3 = Fan/Pmp-V/Hz
Default: 0 = Sensrls Vect
Access: 0 **Path:** Motor Control > Torq Attributes
See also: 62, 63, 69, 70

Sets the method of motor torque production.

54 Maximum Voltage

Range: (Rated Volts x 0.25) to Rated Volts [0.1V AC]
Default: Drive Rated Volts
Access: 0 **Path:** Motor Control > Torq Attributes
See also: rectifier 107

Sets the highest RMS voltage the drive will output. See description of rectifier Max Motor Volts parameter (107 in rectifiers parameters).

55 Maximum Freq

Range: 5.0...250.0 Hz [0.1 Hz]

Default: 130.0 Hz

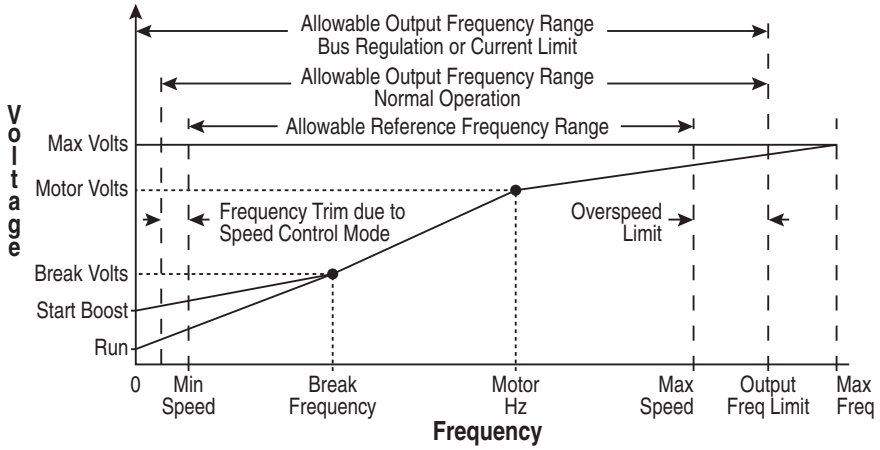
Access: 0 **Path:** Motor Control > Torq Attributes

See also: 82, 83, rectifier 108

Sets the maximum allowable frequency the drive will output. Note that this is not maximum speed, which is set in parameter 82. See Figure 36.

See description of rectifier Max Motor Freq parameter (108 in rectifiers parameters).

Figure 36 - Speed Limits



56 Compensation

Range: See Figure 37

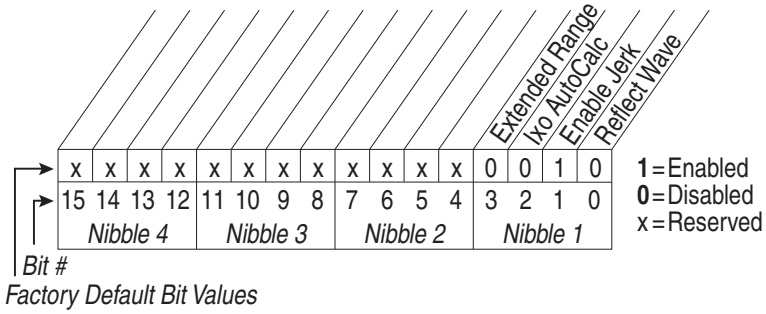
Default: See Figure 37

Access: 1 **Path:** Motor Control > Torq Attributes

See also:

Enables/disables the compensation correction options.

Figure 37 - Compensation (56)


Extended Range
Ixo AutoCalc
Enable Jerk
Reflect Wave
x x x x x x x x x x x x 0 0 1 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Enabled
0 = Disabled
x = Reserved
Factory Default Bit Values

Bit 0 – Reflect Wave

- Enables/disables reflected wave correction software, which reduces overvoltage transients from the drive to the motor. For lead lengths beyond 91 m (300 ft), enable this feature.

Bit 1 – Enable Jerk

- Enables/disables the jerk limit in the current limiter that helps to eliminate overcurrent trips on fast accelerations. Disable this feature if your application requires the actual acceleration of the motor to be faster than .25 seconds.

Bit 2 – IXo Auto Calc

- This bit has no function in Liquiflo 2.0 drives.

Bit 3 – Extend Range

- This bit is for engineering use only.

57 Flux Up Mode

Range:	0 = Manual 1 = Automatic		
Default:	0 = Manual		
Access:	1	**Path:**	Motor Control > Torq Attributes
See also:	53, 58		

Manual (0) = Flux is established for Flux Up Time (58) before acceleration.

Auto (1) = Flux is established for a calculated time period based on motor nameplate data. Flux Up Time (58) is not used.

58 Flux Up Time

Range:	0.00...5.00 sec [0.01 sec]		
Default:	0.0 sec		
Access:	1	**Path:**	Motor Control > Torq Attributes
See also:	53, 58		

Sets the amount of time the drive uses to try to achieve full motor stator flux. When a start command is issued, DC current at current limit level is used to build stator flux before accelerating.

59 SV Boost Filter

Range:	0...32767		
Default:	500		
Access:	1	**Path:**	Motor Control > Torq Attributes
See also:			

Sets the amount of filtering used to boost voltage during Sensorless Vector operation.

61 Autotune

Range:	0 = Ready 1 = Static Tune 2 = Rotate Tune 3 = Calculate
Default:	3 = Calculate
Access:	0 **Path:** Motor Control > Torq Attributes
See also:	53, 62, 63

Provides a manual or automatic method for setting IR Voltage Drop (62) and Flux Current Ref (63), which affect sensorless vector performance. Valid only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize.

Ready (0) = Parameter returns to this setting following a Static Tune or Rotate Tune. It also permits manually setting IR Voltage Drop (62) and Flux Current Ref (63).

Static Tune (1) = A temporary command that initiates a non-rotational motor stator resistance test for the best possible automatic setting of IR Voltage Drop. A start command is required following the initiation of this setting. The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode. Used when the motor cannot be uncoupled from the load.

Rotate Tune (2) = A temporary command that initiates a Static Tune followed by a rotational test for the best possible automatic setting of Flux Current Ref. A start command is required following initiation of this setting.

The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode.

ATTENTION: Rotation of the motor in an undesired direction can occur during this procedure (Autotune [61] = Rotate Tune [2]). To guard against possible injury and/or equipment damage, it is recommended that the motor be disconnected from the load before proceeding.

IMPORTANT Rotate Tune (2) is used when motor is uncoupled from the load. Results may not be valid if a load is coupled to the motor during this procedure.

Calculate (3) = This setting uses motor nameplate data to automatically set IR Voltage Drop and Flux Current Ref.

62 IR Voltage Drop

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]	
Default:	Based on Drive Rating	
Access:	1	**Path:** Motor Control > Torq Attributes
See also:	53	

Value of volts dropped across the resistance of the motor stator. Used only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize.

When inverter Autotune (61) is set to **Calculate**, the value of this parameter is set according to the motor nameplate parameters, and you cannot write to this parameter.

63 Flux Current Ref

32

Range:	0.00 to Drive Rated Amps [0.01 A]	
Default:	Based on Drive Rating	
Access:	1	**Path:** Motor Control > Torq Attributes
See also:	53	

Value of RMS motor amps for full motor flux. Used only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize.

When inverter Autotune (61) is set to **Calculate**, the value of this parameter is set according to the motor nameplate parameters, and you cannot write to this parameter.

64 Ixo Voltage Drop

Range:	0.00...20.0V [0.1V AC]	
Default:	0.0V AC	
Access:	1	**Path:** Motor Control > Torq Attributes
See also:		

This parameter should be left at its default value of 0.0V AC.

69 Start/Acc Boost

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]	
Default:	Based on drive rating	
Access:	1	**Path:** Motor Control > Volts per Hertz
See also:	53, 70, 83	

Sets the voltage boost level for starting and acceleration when Custom V/Hz mode is selected in Torque Perf Mode (53).

70 Run Boost

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]
Default:	Based on drive rating
Access:	1 **Path:** Motor Control > Volts per Hertz
See also:	53, 69, 83

Sets the boost level for steady state or deceleration when Fan/Pmp V/Hz or Custom V/Hz modes are selected in Torque Perf Mode (53).

71 Break Voltage

Range:	0.0 to Motor NP Volts [0.1V AC]
Default:	Motor NP Volts x 0.25
Access:	1 **Path:** Motor Control > Volts per Hertz
See also:	53, 72, 83

Sets the voltage the drive will output at Break Frequency (72).

72 Break Frequency

Range:	0.0...250.0 [0.1 Hz]
Default:	Motor NP Freq x 0.25
Access:	1 **Path:** Motor Control > Volts per Hertz
See also:	53, 71, 83

Sets the frequency the drive will output at Break Voltage (71).

80 Speed Mode

Range:	0 = Open Loop 1 = Slip Comp 2 = Process PI
Default:	0 = Open Loop
Access:	1 **Path:** Speed Command > Spd Mode & Limits
See also:	124...138

Sets the method of speed regulation.

81 Minimum Speed

Range: 0.0 to Maximum Speed [0.1 Hz]
Default: 0.0 Hz
Access: 0 **Path:** Speed Command > Spd Mode & Limits
See also: 83, 92, 95

Sets the low limit for the speed reference after scaling is applied.

ATTENTION: The drive can operate at and maintain zero speed. You are responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

82 Maximum Speed

Range: 5.0...250.0 [0.1 Hz]
Default: 60.0 Hz
Access: 0 **Path:** Speed Command > Spd Mode & Limits
See also: 55, 83, 91, 94, 202

Sets the high limit for the speed reference after scaling is applied.

ATTENTION: You are responsible for ensuring that driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. See Figure 38. Failure to observe this precaution could result in bodily injury.

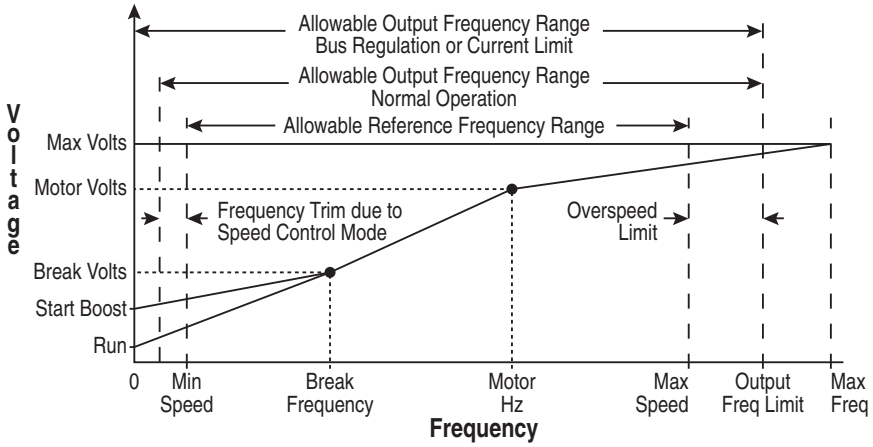
83 Overspeed Limit

Range:	0.0...20.0 Hz [0.1 Hz]	
Default:	10.0 Hz	
Access:	1	**Path:** Speed Command > Spd Mode & Limits
See also:	55, 82	

Sets the incremental amount of the output frequency (above Maximum Speed) allowable for functions such as slip compensation. See Figure 38.

Maximum Speed + Overspeed Limit **must be** ≤to Maximum Frequency.

Figure 38 - Speed Limits



84 Skip Frequency 1
85 Skip Frequency 2
86 Skip Frequency 3

Range:	-/+250.0 [0.1 Hz]	
Default:	0.0 Hz	
Access:	1	**Path:** Speed Command > Spd Mode & Limits
See also:	87	

Sets a frequency at which the drive will not operate (also called an **avoidance frequency**). Requires that both Skip Frequency 1...3 and Skip Frequency Band (87) be set to a value other than 0.

87 Skip Freq Band

Range:	0.0...30.0 Hz [0.1 Hz]
Default:	0.0 Hz
Access:	1 **Path:** Speed Command > Spd Mode & Limits
See also:	84, 85, 86

Determines the bandwidth around a skip frequency (half the band above and half the band below the skip frequency).

90 Speed Ref A Sel

Range:	1 = Analog In 1 2 = Analog In 2 3...8 = Reserved 9 = MOP Level 10 = Reserved 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Preset Spd 7 18 = DPI Port 1 19 = DPI Port 2 20 = DPI Port 3 21 = DPI Port 4 22 = DPI Port 5
Default:	17 = Preset Spd 7
Access:	0 **Path:** Speed Command > Speed References
See also:	2, 91...93, 101...107, 117...120, 192...194, 213, 272, 273, 361...366

Selects the source of the speed reference to the drive unless Preset Speed 1...7 (101...107) is selected.

Note that the manual reference command can override the reference control source.

ATTENTION: Removing and replacing the OIM while the drive is running may cause an abrupt speed change if the OIM is the selected reference source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

91 Speed Ref A Hi

Range:	-/+Maximum Speed [0.1 Hz]
Default:	Maximum Speed
Access:	0 **Path:** Speed Command > Speed References
See also:	82

Scales the upper value of the Speed Ref A Sel (90) selection when the source is an analog input.

92 Speed Ref A Lo

Range:	-/+Maximum Speed [0.1 Hz]
Default:	0.0 Hz
Access:	0 **Path:** Speed Command > Speed References
See also:	81

Scales the lower value of the Speed Ref A Sel (90) selection when the source is an analog input.

93 Speed Ref B Sel

Range:	1 = Analog In 1 2 = Analog In 2 3...8 = Reserved 9 = MOP Level 10 = Reserved 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Preset Spd 7 18 = DPI Port 1 19 = DPI Port 2 20 = DPI Port 3 21 = DPI Port 4 22 = DPI Port 5
Default:	17 = Preset Spd 7
Access:	0 **Path:** Speed Command > Speed References
See also:	2, 91...93, 101...107, 117...120, 192...194, 213, 272, 273, 361...366

Selects the source of the speed reference to the drive unless Preset Speed 1...7 (101...107) is selected.

Note that the manual reference command can override the reference control source.

ATTENTION: Removing and replacing the OIM while the drive is running may cause an abrupt speed change if the OIM is the selected reference source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

94 Speed Ref B Hi

Range:	-/+Maximum Speed [0.1 Hz]
Default:	Maximum Speed
Access:	0 **Path:** Speed Command > Speed References
See also:	82

Scales the upper value of the Speed Ref B Sel (93) selection when the source is an analog input.

95 Speed Ref B Lo

Range:	-/+Maximum Speed [0.1 Hz]
Default:	0.0 Hz
Access:	0 **Path:** Speed Command > Speed References
See also:	81

Scales the lower value of the Speed Ref B Sel (93) selection when the source is an analog input.

96 TB Man Ref Sel

Range:	1 = Analog In 1 2 = Analog In 2 3...8 = Reserved 9 = MOP Level
Default:	2 = Analog In 1
Access:	0 **Path:** Speed Command > Speed References
See also:	97, 98

Specifies the manual speed reference source when a digital input is configured for auto/manual and manual reference mode is active.

97 TB Man Ref Hi

Range: -/+Maximum Speed [0.1 Hz]
Default: Maximum Speed
Access: 0 **Path:** Speed Command > Speed References
See also: 96

Scales the upper value of the TB Man Ref Sel selection when the source is an analog input.

98 TB Man Ref Lo

Range: -/+Maximum Speed [0.1 Hz]
Default: 0.0 Hz
Access: 0 **Path:** Speed Command > Speed References
See also: 96

Scales the lower value of the TB Man Ref Sel selection when the source is an analog input.

100 Jog Speed

Range: 0 to Maximum Speed [0.1 Hz]
Default: 10.0 Hz
Access: 0 **Path:** Speed Command > Discrete Speeds
See also:

Sets the output frequency when a jog command is issued.

101 Preset Speed 1
102 Preset Speed 2
103 Preset Speed 3
104 Preset Speed 4
105 Preset Speed 5
106 Preset Speed 6
107 Preset Speed 7

Range: -/+Maximum Speed [0.1 Hz]
Default: See Table 7 on page 94
Access: 101...107 = 0 **Path:** Speed Command > Discrete Speeds
See also: 90, 93

Provides an internal fixed speed command value when Speed Ref A = Preset Spd 1...7.

Table 7 - Default Values for Preset Speeds 1...7

Parameter No.	Parameter Name	Default
101	Preset Speed 1	5.0 Hz
102	Preset Speed 2	10.0 Hz
103	Preset Speed 3	20.0 Hz
104	Preset Speed 4	30.0 Hz
105	Preset Speed 5	40.0 Hz
106	Preset Speed 6	50.0 Hz
107	Preset Speed 7	60.0 Hz

117 Trim In Select

Range: 1 = Analog In 1
2 = Analog In 2
3...8 = Reserved
9 = MOP Level
10 = Reserved
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = DPI Port 1
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = DPI Port 5

Default: 2 = Analog In 2

Access: 1 **Path:** Speed Command > Speed Trim

See also: 90, 93

Specifies which input signal is being used as a trim input.

118 Trim Out Select

Range: See Figure 39

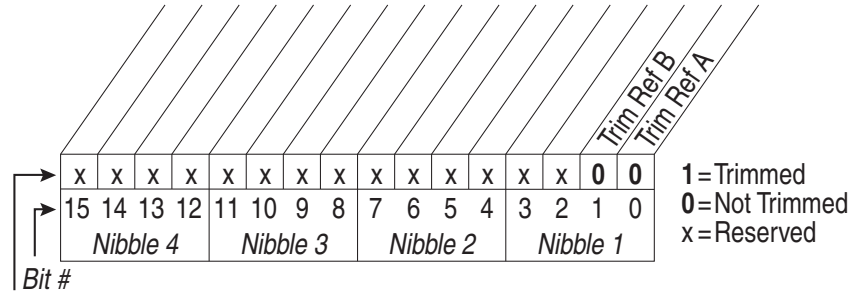
Default: See Figure 39

Access: 1 **Path:** Speed Command > Speed Trim

See also: 117, 119, 120

Specifies if Ref A speed reference or Ref B speed reference is to be trimmed.

Figure 39 - Trim Out Select (118)


Trim Ref B
Trim Ref A
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Trimmed
0 = Not Trimmed
x = Reserved

Factory Default Bit Values

119 Trim Hi

Range:	-/+Maximum Speed [0.1 Hz]
Default:	60.0 Hz
Access:	1 **Path:** Speed Command > Speed Trim
See also:	82, 117

Scales the upper value of the Trim In Select (117) selection when the source is an analog input.

120 Trim Lo

Range:	-/+Maximum Speed [0.1 Hz]
Default:	0.0 Hz
Access:	1 **Path:** Speed Command > Speed Trim
See also:	117

Scales the lower value of the Trim In Select (117) selection when the source is an analog input.

121 Slip RPM @ FLA

Range:	0.0...1200.0 RPM
Default:	Based on Motor NP RPM
Access:	1 **Path:** Speed Command > Slip Comp
See also:	61, 80, 122, 123

Sets the amount of compensation to drive output at motor FLA. If parameter 61 (Autotune) = 3 (Calculate), changes made to this parameter are not accepted.

Parameters in the Slip Comp Group (121...123) are used to enable and tune the slip compensation regulator. To allow the slip compensation regulator to control drive operation, Speed Mode (80) must be set to 1 (Slip Comp).

122 Slip Comp Gain

Range:	1.0...100.0 [0.1]
Default:	40.0
Access:	1 **Path:** Speed Command > Slip Comp
See also:	80, 121, 122

Sets the response time of slip compensation.

Parameters in the Slip Comp Group (121...123) are used to enable and tune the slip compensation regulator. To allow the slip compensation regulator to control drive operation, Speed Mode (80) must be set to 1 (Slip Comp).

123 Slip RPM Meter

Range:	-/+300.0 RPM
Default:	Read Only
Access:	1 **Path:** Speed Command > Slip Comp
See also:	80, 121, 122

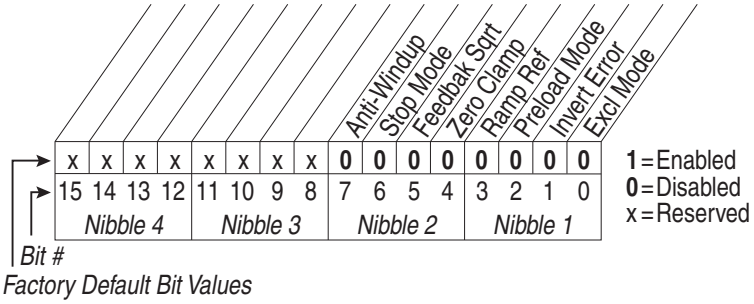
Displays the present amount of adjustment being applied as slip compensation.

124 PI Configuration

Range:	See Figure 40
Default:	See Figure 40
Access:	1 **Path:** Speed Command > Process PI
See also:	125...138

Selects specific features of the PI regulator.

Figure 40 - PI Configuration (124)



Factory Default Bit Values

Bit 0 – Excl Mode (Exclusive Mode)

- Enabled = Selects speed regulation.
- Disabled = Selects trim regulation.

Bit 1 – Invert Error

- Enables/disables the option to invert the sign of the PI error signal. Enabling this feature creates a decrease in output for an increasing error and an increase in output for a decreasing error.

Bit 2 – Preload Mode

- Enabled = Initializes the PI integrator to the commanded speed while the PI is disabled.
- Disabled = The PI integrator is loaded with the PI Pre-load (133) while the PI is disabled.

Bit 3 – Ramp Ref

- Enables/disables ramping the reference used from PI Feedback to the selected PI Reference.

Bit 4 – Zero Clamp

- Enables/disables option to limit operation so that the output frequency always has the same sign as the master speed reference. This limits the possible drive action to one direction only. Output from the drive is from zero to maximum frequency forward or zero to maximum frequency reverse.

Bit 5 – Feedback Sqrt (Square Root Feedback)

- Enables/disables the option of using the square root of the feedback signal as the PI feedback.

Bit 6 – Stop Mode

Bit 7 – Anti-Windup

125 PI Control

Range:	See Figure 41
Default:	See Figure 41
Access:	1 **Path:** Speed Command > Process PI
See also:	124...138

Controls the PI regulator. Note that you must use a datalink to write to this parameter interactively from a network.

PI control allows the drive to take a reference signal (setpoint) and an actual signal (feedback) and automatically adjust the speed of the drive to match the actual signal to the reference.

Proportional control (P) adjusts the output based on the size of the error (larger error = proportionally larger correction).

Integral control (I) adjusts the output based on the duration of the error. The integral control by itself is a ramp output correction. This type of control gives a smoothing effect to the output and continues to integrate until zero error is achieved.

By itself, integral control is slower than many applications require, and therefore, is combined with proportional control (PI).

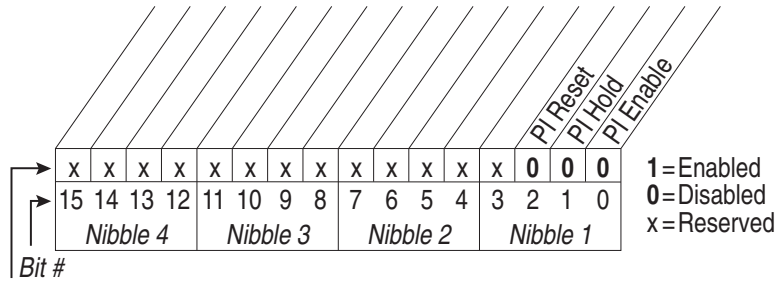
The purpose of the PI regulator is to regulate a process variable such as position, pressure, temperature, or flow rate, by controlling speed.

There are two ways the PI regulator can be configured to operate (see parameter 124):

- **Process trim**, which takes the output of the PI regulator and sums it with a master speed reference to control the process.
- **Process control**, which takes the output of the PI regulator as the speed command. No master speed reference exists, and the PI output directly controls the drive output.

Note that Speed Mode (80) must be set to Process PI (2).

Figure 41 - PI Control (125)


PI Reset
PI Hold
PI Enable
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Enabled
0 = Disabled
x = Reserved
Factory Default Bit Values

Bit 0 - PI Enable

- Enables/disables the operation of the PI loop.

Bit 1 - PI Hold

- Enabled = The integrator for the outer control loop is held at the current level; that is, it will not increase.
- Enabled = The integrator for the outer PI control loop is allowed to increase.

Bit 2 - PI Reset

- Enabled = The integrator for the outer PI control loop is reset to zero.
- Disabled = The integrator for the outer PI control loop integrates normally.

126 PI Reference Sel

Range:	0 = PI Setpoint 1 = Analog In 1 2 = Analog In 2 3...8 = Reserved 9 = MOP Level 10 = Master Ref 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Preset Spd 7 18 = DPI Port 1 19 = DPI Port 2 20 = DPI Port 3 21 = DPI Port 4 22 = DPI Port 5
Default:	0 = PI Setpoint
Access:	1 **Path:** Speed Command > Process PI
See also:	124...138

Selects the source of the PI reference signal.

127 PI Setpoint

Range:	-/+100.00% of Maximum Process Value [0.01%]
Default:	50.00%
Access:	1 **Path:** Speed Command > Process PI
See also:	124...138

Provides an internal fixed value for the process setpoint when PI Reference Sel (126) is set to PI Setpoint.

128 PI Feedback Sel

Range: 0 = PI Setpoint
1 = Analog In 1
2 = Analog In 2
3...8 = Reserved
9 = MOP Level
10 = Master Ref
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = DPI Port 1
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = DPI Port 5

Default: 2 = Analog In 2

Access: 1 **Path:** Speed Command > Process PI

See also: 124...138

Selects the source of the PI feedback signal.

129 PI Integral Time

Range: 0.00...100.00 sec [0.01 sec]

Default: 2.00 sec

Access: 1 **Path:** Speed Command > Process PI

See also: 124...138

Specifies the time required for the integral component to reach 100% of PI Error Meter (137).

130 PI Prop Gain

Range: 0.00...100.00 [0.01]
Default: 1.00
Access: 1 **Path:** Speed Command > Process PI
See also: 124...138

Sets the value for the PI proportional component when the PI Hold bit of PI Control (125) = Enabled (1).

PI Error x PI Prop Gain = PI Output

131 PI Lower Limit

Range: -/+Maximum Frequency [0.1 Hz]
Default: -Maximum Freq
Access: 1 **Path:** Speed Command > Process PI
See also: 124...138

Sets the lower limit of the PI output. This value must be less than the value set in PI Upper Limit (132).

132 PI Upper Limit

Range: -/+Maximum Frequency [0.1 Hz]
Default: +Maximum Freq
Access: 1 **Path:** Speed Command > Process PI
See also: 124...138

Sets the upper limit of the PI output. This value must be greater than the value set in PI Lower Limit (131).

133 PI Preload

Range: -/+Maximum Frequency [0.1 Hz]
Default: 0.0 Hz
Access: 1 **Path:** Speed Command > Process PI
See also: 124...138

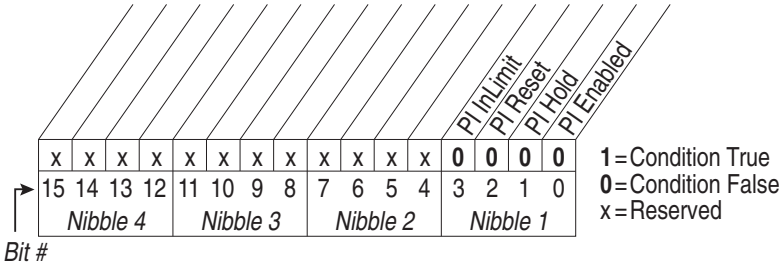
Sets the value used to load into the PI Integrator when PI is not enabled.

134 PI Status

Range: See Figure 42
Default: Read Only
Access: 1 **Path:** Speed Command > Process PI
See also: 124...138

The present state of the process PI regulator.

Figure 42 - PI Status (134)


PI InLimit
PI Reset
PI Hold
PI Enabled
x x x x x x x x x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Bit 0 – PI Enabled

- Indicates whether or not the PI loop is enabled.

Bit 1 – PI Hold

- Is set to 1 to indicate when a digital input is configured for PI Hold and is turned on, or the PI Hold bit is set in PI Control (125).

Bit 2 – PI Reset

- Is set to 1 to indicate when the PI Integrator is being reset to zero.

Bit 3 – PI InLimit

- Is set to 1 to indicate when the PI output equals positive limit or negative limit.

135 PI Ref Meter

Range: -/+100.00% [0.01%]

Default: Read Only

Access: 1 **Path:** Speed Command > Process PI

See also: 124...138

Present value of the PI reference signal.

136 PI Fdback Meter

Range: -/+100.00% [0.01%]

Default: Read Only

Access: 1 **Path:** Speed Command > Process PI

See also: 124...138

Present value of the PI feedback signal.

137 PI Error Meter

Range:	-/+100.00% [0.01%]
Default:	Read Only
Access:	1 **Path:** Speed Command > Process PI
See also:	124...138

Present value of the PI error signal.

138 PI Output Meter

Range:	100.0 Hz [0.1 Hz]
Default:	Read Only
Access:	1 **Path:** Speed Command > Process PI
See also:	124...138

Present value of the PI output signal.

140 Accel Time 1
141 Accel Time 2

Range:	0.1...100.0 [0.1 sec]
Default:	10.0
Access:	140 = 0 **Path:** Dynamic Control > Ramp Rates 141 = 0
See also:	142, 143, 146, 361...366

The Accel Time parameters set the rate at which the drive ramps to its output frequency after a start command or during an increase in command frequency (speed change). The rate established is the result of the following equation:

(Maximum Speed ÷ Accel Time) = Accel Rate

Two accel times exist to enable acceleration rate changes **on the fly** using a building automation system command or digital input, if configured.

142 Decel Time 1
143 Decel Time 2

Range: 0.1...100.0 sec [0.1 sec]

Default: 10.0 sec

Access: 142 = 0 **Path:** Dynamic Control > Ramp Rates
143 = 0

See also: 142, 143, 146, 361...366

Sets the rate of deceleration for all speed decreases.

(Max Speed ÷ Decel Time) = Decel Rate

Two decel times exist to enable deceleration rate changes **on the fly** using a building automation system command or digital input, if configured.

146 S Curve %

Range: 0...100% [1%]

Default: 0%

Access: 0 **Path:** Dynamic Control > Ramp Rates

See also: 140...143

Sets the percentage of acceleration or deceleration time that is applied to the ramp as S Curve. Time is added; 1/2 at the beginning and 1/2 at the end of the ramp.

147 Current Lmt Sel

Range: 0 = Curr Lim Val
1 = Analog In 1
2 = Analog In 2

Default: 0 = Cur Lim Val

Access: 0 **Path:** Dynamic Control > Load Limits

See also: 148, 149

Selects the source for the adjustment of current limit (i.e., parameter, analog input, etc.).

148 Current Lmt Val

Range: Based on Drive Type [0.1 A]

Default: Based on Drive Type (approximately 150%)

Access: 0 **Path:** Dynamic Control > Load Limits

See also: 147, 149

Defines the RMS current limit value when Current Lmt Sel (147) = Cur Lim Val.

149 Current Lmt Gain

Range: 0...5000 [1]

Default: 200

Access: 1 **Path:** Dynamic Control > Load Limits

See also: 147, 148

Sets the responsiveness of the current limit.

150 Drive OL Mode

Range: 0 = Disabled
1 = Reduce CLim
2 = Reduce PWM
3 = Both-PWM 1st

Default: 0 = Disabled

Access: 1 **Path:** Dynamic Control > Load Limits

See also: 219

Selects the drive's response to increasing drive temperature.

151 PWM Frequency

Range: 2...4 kHz [1 kHz]

Default: 2 kHz

Access: 1 **Path:** Dynamic Control > Load Limits

See also: 146, 149

Sets the carrier frequency for the PWM output. Drive derating may occur at higher carrier frequencies. For derating information, see Appendix A.

If the Carrier Sync Lost fault (fault 247) is enabled using rectifier Fault Config (rectifier 238), then setting the PWM Frequency (151) to anything other than 4 kHz causes an immediate Carrier Sync Lost fault (fault 247).

155 Stop Mode A
156 Stop Mode B

Range: 0 = Coast
1 = Ramp
2 = Ramp to Hold
3 = DC Brake

Default: 155: 0 = Coast
156: 0 = Coast

Access: 155 = 0 **Path:** Dynamic Control > Stop/Brake Modes
156 = 0

See also: 157...159, 361...366

Active stop mode. Stop Mode A is active unless Stop Mode B is selected by a digital input.

ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

157 DC Brake Lvl Sel

Range:	0 = DC Brake Lvl 1 = Analog In 1 2 = Analog In 2
Default:	0 = DC Brake Lvl
Access:	0 **Path:** Dynamic Control > Stop/Brake Modes
See also:	155, 156, 158, 159

Selects the source for DC Brake Level (158).

158 DC Brake Level

Range:	0 to (Rated Amps x 1.5) [0.1 A]
Default:	Rated Amps
Access:	0 **Path:** Dynamic Control > Stop/Brake Modes
See also:	157...159

Defines the maximum DC brake current in percentage of drive rated current.

The DC braking voltage used in this function is created by a PWM algorithm and may not generate the smooth holding force needed for some applications.

ATTENTION: If a hazard of injury due to movement of equipment or material exists, an auxiliary mechanical braking device must be used to stop the motor. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: This feature should not be used with synchronous or permanent magnet motors. Motors may be demagnetized during braking. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

159 DC Brake Time

Range:	0.0...90.0 sec [0.1 sec]
Default:	0.0 sec
Access:	0 **Path:** Dynamic Control > Stop/Brake Modes
See also:	155...158

Sets the amount of time DC brake current is **injected** into the motor.

160 Bus Reg Ki

Range:	0...5000 [1]	
Default:	450	
Access:	1	**Path:** Dynamic Control > Stop/Brake Modes
See also:	161, 162	

Sets the responsiveness of the bus regulator.

161 Bus Reg Mode A
162 Bus Reg Mode B

Range:	0 = Disabled 1 = Adjust Freq 2 = Dynamic Brak 3 = Both - DB 1st 4 = Both - Frq 1st	
Default:	Mode A: 0 = Disabled Mode B: 0 = Disabled	
Access:	0	**Path:** Dynamic Control > Stop/Brake Modes
See also:	160, 163, 361...366	

Sets the method and sequence of the DC bus regulator voltage. Choices are dynamic brake, frequency adjust, or both.

Sequence is determined by programming or digital input to the terminal block.

If a dynamic brake resistor is connected to the drive, Bus Reg Mode A and Bus Reg Mode B must be set to option 2, 3, or 4.

For the LiquiFlo 2.0 drive, **always** set this parameter to 0 (Disabled).

ATTENTION: The adjust freq portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur:

- Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes; however, an OverSpeed Limit fault occurs if the speed reaches Max Speed + Overspeed Limit. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive, and 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the adjust freq portion of the bus regulator function must be disabled (see parameters 161 and 162).
- Actual deceleration times can be longer than commanded deceleration times; however, a Decel Inhibit fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the adjust freq portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor provides equal or better performance in most cases.

Note that these faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

163 DB Resistor Type

Range:	0 = Internal Res 1 = External Res 2 = None	
Default:	2 = None	
Access:	0	**Path:** Dynamic Control > Stop/Brake Modes
See also:	161, 162	

Selects whether the internal or an external DB resistor is used.

164 Bus Reg Kp

Range:	0...10000	
Default:	1200	
Access:	1	**Path:** Dynamic Control > Stop/Brake Modes
See also:		

Proportional gain for the bus regulator. Used to adjust regulator response.

165 Bus Reg Kd

Range:	0...10000	
Default:	1000	
Access:	1	**Path:** Dynamic Control > Stop/Brake Modes
See also:		

Derivative gain for the bus regulator. Used to control regulator overshoot.

168 Start At PowerUp

Range:	0 = Disabled	
Default:	0 = Disabled	
Access:	0	**Path:** Dynamic Control > Stop/Restart Modes
See also:		

This parameter is not used with LiquiFlo 2.0 AC drives.

169 Flying Start En

Range:	0 = Disabled 1 = Enabled	
Default:	0 = Disabled	
Access:	1	**Path:** Dynamic Control > Stop/Restart Modes
See also:	170	

Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued.

170 Flying Start Gain

Range:	20...32767 [1]	
Default:	4000	
Access:	1	**Path:** Dynamic Control > Restart Modes
See also:	169	

Adjusts the responsiveness of the flying start function. Increasing the value in this parameter increases the responsiveness of the flying start function.

174 Auto Rstrt Tries

Range:	0...9 [1]	
Default:	0 (Disabled)	
Access:	0	**Path:** Dynamic Control > Restart Modes
See also:	175	

ATTENTION: Equipment damage and/or personal injury may result if parameter 174 is used in an inappropriate application. Do not use this function without considering applicable local, national, and international codes, standards, regulations, or industry guidelines.

IMPORTANT The drive re-starts after a fault reset if the start input is still asserted.

Specifies the maximum number of times the drive attempts to reset a fault and restart when the auto restart feature is enabled.

The auto restart feature provides the ability for the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. Only certain faults are permitted to be reset. See Chapter 10 for more information.

When the auto restart feature is enabled (that is, Auto Rstrt Tries is set to a value greater than zero), and an auto-resettable fault occurs, the drive stops. After the number of seconds in Auto Restrt Delay (175) has elapsed, the drive automatically resets the faulted condition. The drive then issues an internal start command to start the drive.

If another auto-resettable fault occurs, the cycle repeats up to the number of attempts specified in Auto Rstrt Tries.

If the drive faults repeatedly for more than the number of attempts specified in Auto Rstrt Tries with less than 5 minutes between each fault, the drive remains in the faulted state. The fault Auto Rstrt Tries are logged in the fault queue.

The auto restart feature is disabled when the drive is stopping and during autotuning. Note that a DC Hold state is considered stopping.

The following conditions abort the reset/run process:

- Issuing a stop command from any control source. (Note that removal of a 2-wire run-fwd or run-rev command is considered a stop command.)
- Issuing a fault reset command from any active source.
- Removing the enable input signal.
- Setting Auto Restrt Tries to zero.
- Occurrence of a fault that is not auto-resettable.
- Removing power from the drive.
- Exhausting an auto-reset/run cycle.

Note that two auto-restart status bits are provided in Drive Status 2 (210): an **active status** bit and a **countdown status** bit.

175 Auto Rstrt Delay

Range:	0.5...30.0 sec [0.1 sec]	
Default:	1.0 sec	
Access:	0	**Path:** Dynamic Control > Restart Modes
See also:	174	

Sets the time between restart attempts when the auto restart feature is enabled. See Auto Rstrt Tries (174) for more information about the auto restart feature.

178 Sleep-Wake Mode

Range: 0 = Disabled

Default: 0 = Disabled

Access: 1 **Path:** Dynamic Control > Restart Modes

See also:

Enables the Sleep-Wake function. This parameter is not used with LiquiFlo 2.0 AC drives.

179 Sleep-Wake Ref

Range: 1 = Analog In 1
2 = Analog In 2

Default: 2 = Analog In 2

Access: 1 **Path:** Dynamic Control > Restart Modes

See also:

Selects the source of the input controlling the Sleep-Wake function. This parameter is not used with LiquiFlo 2.0 AC drives.

180 Wake Level

Range: Sleep Level/20.000 mA, 10.000V [0.001 mA, 0.001V]

Default: 6.000 mA, 6.000V

Access: 1 **Path:** Dynamic Control > Restart Modes

See also: 181

Defines the analog input level that starts the drive. This parameter is not used with LiquiFlo 2.0 AC drives.

181 Wake Time

Range: 0.0...30.0 [0.1 sec]

Default: 1.0

Access: 1 **Path:** Dynamic Control > Restart Modes

See also: 180

Defines the amount of time at or above Wake Level before a start command is issued. This parameter is not used with LiquiFlo 2.0 AC drives.

182 Sleep Level

Range:	4.000 mA, 0.000V / Wake Level [0.001 mA, 0.001V]
Default:	5.000 mA, 5.000V
Access:	1 **Path:** Dynamic Control > Restart Modes
See also:	183

Defines the analog input level that stops the drive. This parameter is not used with LiquiFlo 2.0 AC drives.

183 Sleep Time

Range:	0.0...30.0 [0.1 sec]
Default:	1.0
Access:	1 **Path:** Dynamic Control > Restart Modes
See also:	182

Defines the amount of time at or below Sleep Level before a stop command is issued. This parameter is not used with LiquiFlo 2.0 AC drives.

184 Power Loss Mode

Range:	0 = Coast 1 = Decel 2 = Continue 3 = Coast input (same as Coast in Liquiflo 2.0 drives) 4 = Decel input (same as Decel in Liquiflo 2.0 drives) 5 = Decel fault
Default:	0 = Coast
Access:	0 **Path:** Dynamic Control > Power Loss
See also:	185, 169, 190, 238, rectifier 64, rectifier 65

Sets the reaction to a loss of input power. If Power Loss Mode is set to:

Coast or **Coast Input**

- Rectifier can no longer synchronize to the AC line, or
- DC bus voltage is ≤73% of its value at the time of the input power loss.

Decel, **Decel Input**, or **Decel Fault**

- Rectifier can no longer synchronize to the AC line, or
- DC bus voltage is ≤82% of its value at the time of the input power loss.

Continue

- Rectifier can no longer synchronize to the AC line, or
- DC bus voltage is ≤305V DC.

When the inverter detects a power loss condition, it enters its power loss state and starts the power loss timer. If the power loss timer expires before the power loss condition ends and the Power Loss fault is enabled, then a Power Loss fault (fault 3) occurs. The inverter only enters its power loss state when it is running.

The Power Loss fault (fault 3) is enabled and disabled using inverter Fault Config 1 (238).

The time that the inverter remains in the power loss state before faulting, is set using inverter Power Loss Time (185). However, if the Power Loss fault is not enabled, then the inverter Power Loss Time parameter has no effect on the response to and recovery from power loss.

If the Power Loss Mode is set to **Coast**, **Continue**, or **Coast Input**, then the inverter handles power loss conditions in the following manner:

- As soon as the power loss condition is detected, the inverter coasts the motor (stop applying voltage)
- If the power loss condition ends before any fault (including a Power Loss fault) occurs, the inverter leaves the power loss state by restarting the motor. The inverter initiates a flying start sequence in order to determine the rotational speed of the motor, and sets the initial output frequency based on that speed. The flying start sequence after a recovery from power loss is not affected by the value of the inverter Flying Start En parameter (169). If the motor is spinning in reverse at the time of the flying start sequence and inverter Direction Mode (190) is set to **Reverse Disable**, then the flying start sequence is not able to match the speed of the motor, and 0 Hz is used as the initial output frequency.

If the Power Loss Mode is set to **Decel**, **Decel Input**, or **Decel Fault**, then the inverter handles power loss conditions in the following manner:

- As soon as the power loss is detected, the inverter starts decelerating the motor in an attempt to use the inertia of the motor to maintain the DC bus voltage at a useful level. This is called **inertial ridethrough**.
- If the output frequency reaches 0 Hz, or the DC bus voltage drops so far that it is not possible to maintain motor voltage, the inverter coasts the motor. At this point, power loss recovery proceeds as for **Coast** mode, described above. However, at the point where the motor is coasted, if the power loss mode is set to **Decel Fault** and the Power Loss fault (fault 3) is enabled, the inverter immediately faults with the Power Loss fault rather than waiting any longer for power to come back or for the timer to expire.
- If the power loss condition ends before any fault (including a Power Loss fault) occurs, and the inverter has been able to maintain motor voltage through the entire power loss, the inverter exits its power loss state by accelerating the motor up to its currently commanded speed using the currently commanded acceleration rate.

Note that the response of the entire drive to loss of AC line synchronization is also affected by rectifier parameters Ride Through Ena (64) and Ride Through Sec (65).

185 Power Loss Time

Range:	0.0...60.0 sec [0.1 sec]
Default:	0.0 sec
Access:	0 **Path:** Dynamic Control > Power Loss
See also:	184, 238

Sets the time that the inverter remains in its power loss state before the Power Loss fault (fault 3) is issued.

If the Power Loss fault is not enabled using the inverter Fault Config 1 parameter (238), the value of Power Loss Time (185) has no effect on the detection of or response to a power loss condition.

186 Power Loss Level

Range:	0.0...999.9 [0.1V DC]
Default:	0.0V DC
Access:	1 **Path:** Dynamic Control > Power Loss
See also:	184, 361...366

When set to a non-zero value, selects the change in DC Bus Voltage level at which the Power Loss occurs.

This value of this parameter is ignored unless one of the digital inputs is configured to the **Pwr Loss Lvl** function using the inverter Digital In*x* Sel parameters (361...366).

In Liquiflo 2.0 drives, this parameter should not be changed from its default, and the digital inputs should not be configured to the **Pwr Loss Lvl** function.

190 Direction Mode

Range:	0 = Unipolar 1 = Bipolar 2 = Reverse Dis
Default:	2 = Reverse Dis
Access:	0 **Path:** Utility > Direction Config
See also:	320...327, 361...366

Selects the source for control of drive direction.

ATTENTION: Setting parameter 190 to 0 or 1 may cause unwanted motor direction. Verify driven machinery cannot be damaged by reverse rotation before changing the setting of this parameter to 0 or 1. Failure to observe this precaution could result in damage to, or destruction of, equipment.

Unipolar = Drive receives unsigned reference (0...32767) and direction command separately (from the DPI port). For example, the direction keys on an OIM apply the direction to the reference.

Bipolar = Drive receives signed reference (-32767...32767). In this case, the direction keys have no effect.

Reverse Disable = Drive receives signed reference (-32767...32767); however, regardless of the reference, the drive is not permitted to reverse.

192 Save HIM Ref

Range: See Figure 43

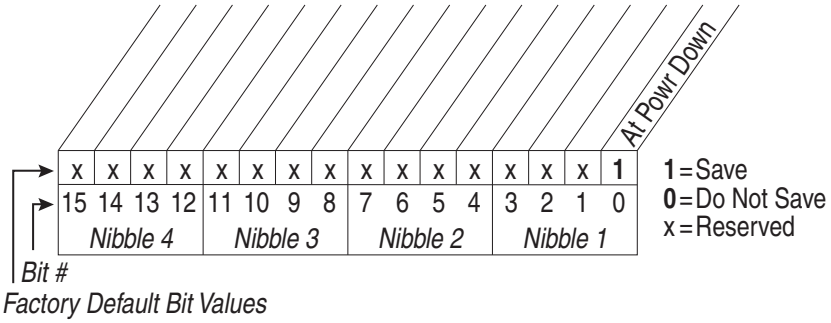
Default: See Figure 43

Access: 1 **Path:** Utility > HIM Ref Config

See also:

Enables a feature to save the present frequency reference value issued by the OIM to drive memory on power loss. Value is restored to the OIM on power up. HIM stands for Human Interface Module. It is another way of referring to the OIM.

Figure 43 - Save OIM Ref (192)


At Powr Down
x x x x x x x x x x x x x x x 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
1 = Save
0 = Do Not Save
x = Reserved
Bit #
Factory Default Bit Values

193 Man Ref Preload

Range: 0 = Disabled
1 = Enabled

Default: 0 = Disabled

Access: 1 **Path:** Utility > HIM Ref Config

See also: 320...327, 361...366

Enables/disables a feature to automatically load the present auto frequency reference value into the OIM when Manual is selected. Allows smooth speed transition from Auto to Manual.

HIM stands for Human Interface Module. It is another way of referring to the OIM.

194 Save MOP Ref

Range: See Figure 44

Default: See Figure 44

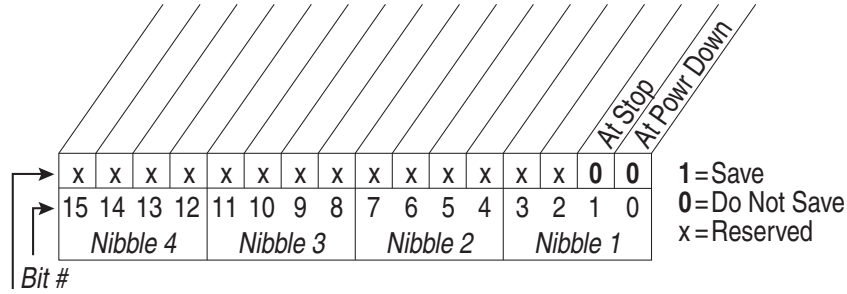
Access: 1 **Path:** Utility > MOP Config

See also:

Enables/disables the feature that saves the present MOP (motor-operated potentiometer) frequency reference at power down or at stop.

The MOP is an output frequency value internal to the drive firmware.

Figure 44 - Save MOP Ref (194)


At Stop
At Powr Down
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Save
0 = Do Not Save
x = Reserved
Factory Default Bit Values

195 MOP Rate

Range: 0.2...250.0 [0.1 Hz/sec]

Default: 1.0 Hz/sec

Access: 1 **Path:** Utility > MOP Config

See also:

Sets the rate of change of the MOP reference in response to a digital input. The MOP is an output frequency value internal to the drive firmware.

196 Param Access Lvl

Range: 0 = Basic
1 = Advanced

Default: 0

Access: 0 **Path:** Utility > Drive Memory

See also:

Displays the present parameter access level. See Selecting the Parameter Access Level on page 63 for more information about parameter access levels.

197 Reset To Defalts

Range: 0 = Ready
1 = Factory
2 = Low Voltage
3 = High Voltage

Default: 0 = Ready

Access: 0 **Path:** Utility > Drive Memory

See also:

Resets all inverter parameter values to defaults. Option 1 resets the inverter to factory settings. Options 2 and 3 resets the inverter to alternate voltage and current rating. After a restore defaults operation is performed, the value of this parameter returns to 0 for **Ready**.

198 Load Frm Usr Set

Range: 0 = Ready
1 = User Set 1
2 = User Set 2
3 = User Set 3

Default: 0 = Ready

Access: 0 **Path:** Utility > Drive Memory

See also: 199

Loads a previously saved set of inverter parameter values from a selected user set location in drive non-volatile memory to active drive memory.

An F-Key on the OIM can be configured for this function. See Appendix B.

After a Load From User Set operation is performed, the value of this parameter returns to 0 for **Ready**.

199 Save To User Set

Range: 0 = Ready
1 = User Set 1
2 = User Set 2
3 = User Set 3

Default: 0 = Ready

Access: 0 **Path:** Utility > Drive Memory

See also: 198

Saves the inverter parameter values in active drive memory to a user set in drive non-volatile memory.

An F-Key on the OIM can be configured for this function. See Appendix B.

After a Save To User Set operation is performed, the value of this parameter returns to 0 for **Ready**.

200 Reset Meters

Range:	0 = Ready 1 = MWh 2 = Elapsed Time
Default:	0 = Ready
Access:	1 **Path:** Utility > Drive Memory
See also:	

Resets selected meters to zero. After a Reset Meters operation is performed, the value of this parameter returns to 0 for **Ready**.

201 Language

Range:	0 = Not Selected 1 = English 2 = Francais 3 = Espanol 4 = Italiano 5 = Deutsch 6 = Reserved 7 = Portugues 10 = Dutch
Default:	0 = Not Selected
Access:	0 **Path:** Utility > Drive Memory
See also:	

Selects the display language when using an OIM.

202 Voltage Class

Range:	2 = Low Voltage 3 = High Voltage
Default:	Based on Drive Type
Access:	1 **Path:** Utility > Drive Memory
See also:	55

Resets selected parameters that change the drive voltage rating, current rating, scaling, and motor data. Maximum Frequency (55) is affected by changing this parameter.

203 Drive Checksum

Range:	0...65535 [1]
Default:	Read Only
Access:	1 **Path:** Utility > Drive Memory
See also:	

Provides a checksum value that indicates whether or not a change in inverter configuration has occurred (data values only).

209 Drive Status 1

Range: See Figure 45

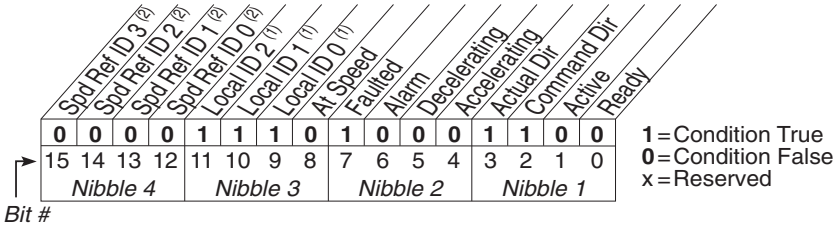
Default: Read Only

Access: 1 **Path:** Utility > Diagnostics

See also: 210

Present operating condition of the drive.

Figure 45 - Drive Status 1 (209)



Bits (2)				Description
15	14	13	12	
0	0	0	0	Ref A Auto
0	0	0	1	Preset 1 Auto
0	0	1	0	Preset 2 Auto
0	0	1	1	Preset 3 Auto
0	1	0	0	Preset 4 Auto
0	1	0	1	Preset 5 Auto
0	1	1	0	Preset 6 Auto
0	1	1	1	Preset 7 Auto
1	0	0	0	TB Manual
1	0	0	1	Port 1 Manual
1	0	1	0	Port 2 Manual
1	0	1	1	Port 3 Manual
1	1	0	0	Port 4 Manual
1	1	0	1	Port 5 Manual
1	1	1	0	Port 6 Manual

Bits (1)			Description
11	10	9	
0	0	0	Port 0 (TB)
0	0	1	Port 1
0	1	0	Port 2
0	1	1	Port 3
1	0	0	Port 4
1	0	1	Port 5
1	1	0	Port 6
1	1	1	No Local Control

210 Drive Status 2

Range: See Figure 46

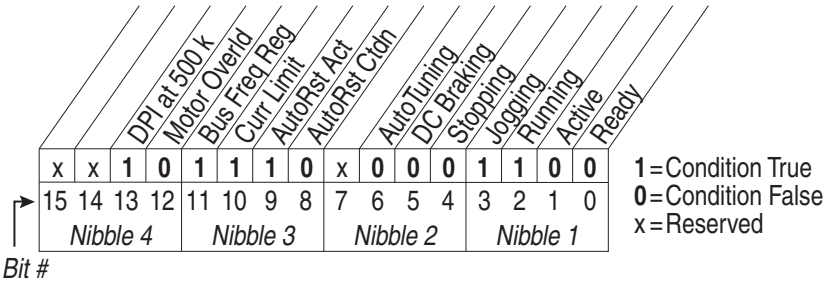
Default: Read Only

Access: 1 **Path:** Utility > Diagnostics

See also: 209

Present operating condition of the drive.

Figure 46 - Drive Status 2 (210)



Bit 0 - Ready = No start inhibits are active.

Bit 1 - Active = Drive is generating output voltage to the motor.

Bit 2 - Running = Drive is generating output voltage to the motor, run has been selected.

Bit 8 - AutoRst Ctdn = Auto Restart Countdown. See parameter 174.

Bit 9 - AutoRst Ac = Auto Restart Active. See parameter 174.

Bit 11 - Bus Freq Reg = Drive is regulating bus frequency.

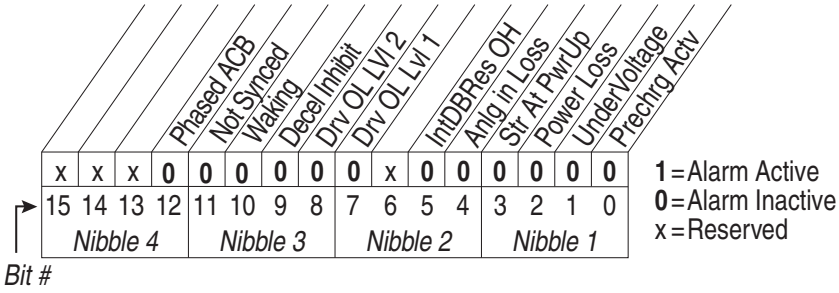
211 Drive Alarm 1

Range:	See Figure 47
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics Utility > Alarms
See also:	212, 259

Indicates Type 1 alarm conditions that currently exist in the drive. Note that for alarm conditions not configured in Alarm Config 1 (259), the status indicated is a zero.

See Chapter 10 for more information about alarms.

Figure 47 - Drive Alarm 1 (211)

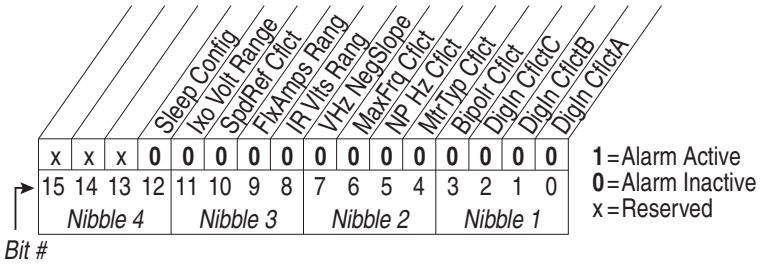


212 Drive Alarm 2

Range:	See Figure 48
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics Utility > Alarms
See also:	211

Indicates Type 2 alarm conditions that currently exist in the drive. See Chapter 10 for more information about alarms.

Figure 48 - Drive Alarm 2 (212)



213 Speed Ref Source

Range: 0 = PI Output
1 = Analog In 1
2 = Analog In 2
3...8 = Reserved
9 = MOP Level
10 = Jog Speed
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = DPI Port 1
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = DPI Port 5
23 = DPI Port 6 (Frame 4 only)

Default: Read Only

Access: 1 **Path:** Utility > Diagnostics

See also: 90, 93, 96, 101

Displays the source of the speed reference of the drive.

214 Start Inhibits

Range: See Figure 49

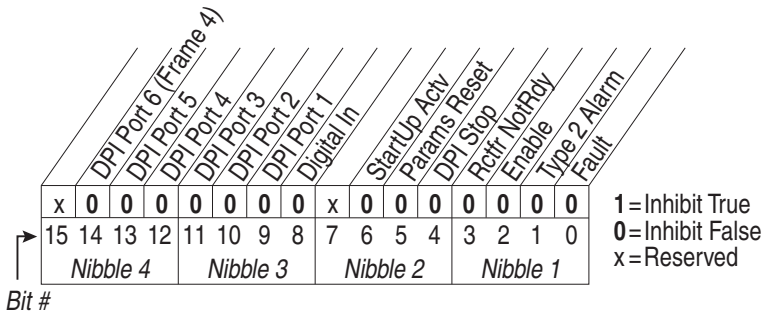
Default: Read Only

Access: 0 **Path:** Utility > Diagnostics

See also:

Displays the drive conditions currently preventing the drive from starting.

Figure 49 - Start Inhibits (214)



215 Last Stop Source

Range: 0 = Pwr Removed
1 = DPI Port 1
2 = DPI Port 2
3 = DPI Port 3
4 = DPI Port 4
5 = DPI Port 5
6 = DPI Port 6 (Frame 4 only)
7 = Digital In
8 = Fault
9 = Not Enabled
10 = Sleep
11 = Jog

Default: Read Only

Access: 1 **Path:** Utility > Diagnostics

See also:

Displays the source that initiated the most recent stop sequence. It is cleared (set to 0) during the next start sequence.

216 Dig In Status

Range: See Figure 50

Default: Read Only

Access: 0 **Path:** Utility > Diagnostics

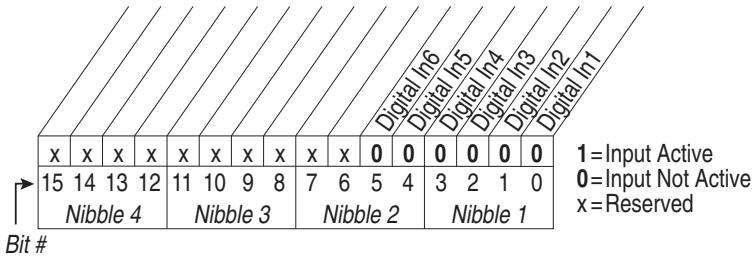
See also: 361...366

For Frame 3 drives, this parameter provides the state of the user-configurable Digital Inputs on the optional A22 Standard I/O board.

For Frame 4 drives, this parameter provides the state of the user-configurable Digital Inputs on the A12 Combined I/O board.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Figure 50 - Dig In Status (216)


Digital In6
Digital In5
Digital In4
Digital In3
Digital In2
Digital In1
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Active
0 = Input Not Active
x = Reserved

For Frame 3 drives (firmware version 1.x), this parameter is only usable if an optional Standard I/O board is present.

217 Dig Out Status

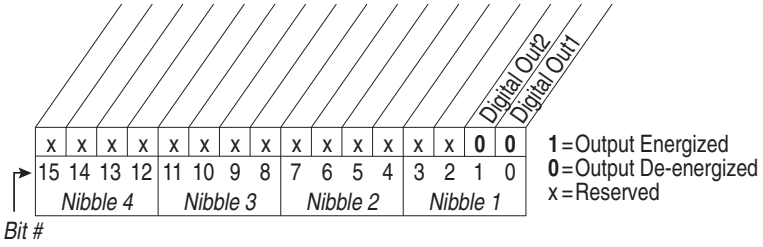
Range:	See Figure 51 and Figure 52
Default:	Read Only
Access:	0 **Path:** Utility > Diagnostics
See also:	30, 380...384

This parameter contains the current state of digital outputs controlled by the inverter. See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Frame 3 drives (firmware version 1.x) only:

Current state of the user-configurable digital outputs. These outputs are located on the optional Standard I/O board, which is not present in all drives.

Figure 51 - Dig Out Status (276) Frame 3

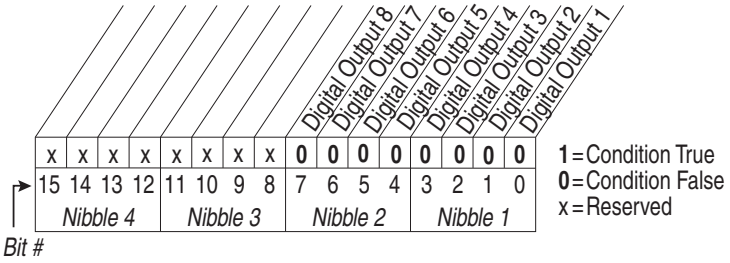

Digital Out2
Digital Out1
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Output Energized
0 = Output De-energized
x = Reserved

Frame 4 drives (firmware version 2.x) only:

Current state of the inverter-controlled digital outputs.

Digital outputs 1 and 2 are the user-configurable digital outputs. Digital Outputs 3...8 are the application controlled digital outputs. All of these digital outputs are located on the Combined I/O board.

Figure 52 - Dig Out Status (276) Frame 4


Digital Output 8
Digital Output 7
Digital Output 6
Digital Output 5
Digital Output 4
Digital Output 3
Digital Output 2
Digital Output 1
x x x x x x x x 0 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Condition True
0 = Condition False
x = Reserved

218 Invtr Base Temp

Range:	-/+100 °C [0.1 °C]
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	

The hottest measured inverter IGBT module temperature is displayed as *x.x* degrees C.

219 Drive OL Count

Range:	0.0...100.0% [0.1%]
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	150

Accumulated percentage of drive overload. Continuously operating the drive over 100% of its rating increases this value to 100% and causes a Drive OverLoad fault (fault 64).

220 Motor OL Count

Range:	0.0...100.0 [1.0%]
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	47, 48

Accumulated percentage of motor overload. Continuously operating the motor over 100% of Motor OL Amps (48) increases this value to 100% and causes a Motor OverLoad fault (fault 7).

221 Imbalance Count

Range:	0.0...100.0 [1.0%]
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	22...24, 49, 50

Displays the imbalance in current between motor phases.

If the imbalance count remains over inverter Imbalance Limit (49) for more than inverter Imbalance Time (50), the Motor I Imbalance fault (fault 37) occurs.

The imbalance in amps is calculated as the larger of:

(largest phase current) – (average phase current), or

(average phase current) – (smallest phase current).

The imbalance in percent is calculated as:

(Imbalance in amps) ÷ (average phase current) x100.

224 Fault Frequency

Range: +/-400.0 Hz [0.1 Hz]
Default: Read Only
Access: 1 **Path:** Utility > Diagnostics
See also: 225...230

Captures and displays the output frequency of the drive at the time of the last fault.

225 Fault Amps

Range: 0.0...3276.7 A [0.1 A]
Default: Read Only
Access: 1 **Path:** Utility > Diagnostics
See also: 224...230

Captures and displays RMS motor amps at the time of the last fault.

226 Fault Bus Volts

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 1 **Path:** Utility > Diagnostics
See also: 224...230

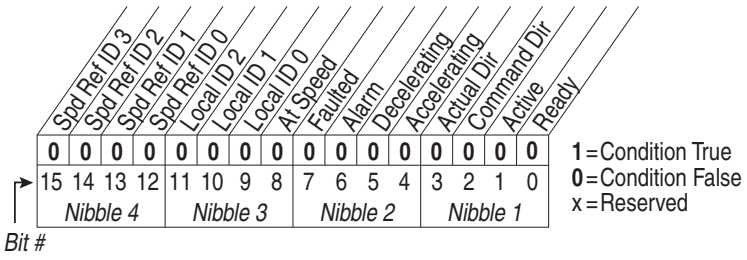
Captures and displays the DC bus voltage of the drive at the time of the last fault.

227 Status 1 @ Fault

Range: See Figure 53
Default: Read Only
Access: 1 **Path:** Utility > Diagnostics
See also: 209, 224...230

Captures and displays Drive Status 1 bit pattern at the time of the last fault.

Figure 53 - Status 1 @ Fault (227)

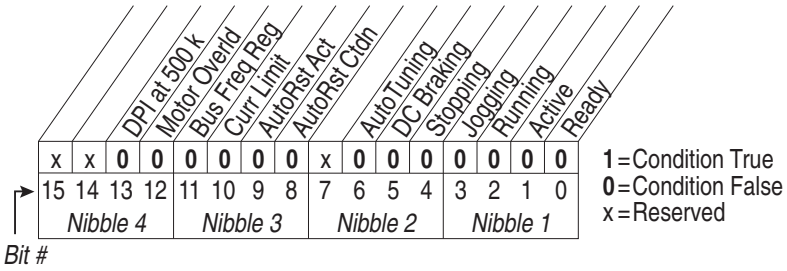


228 Status 2 @ Fault

Range:	See Figure 54
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	210, 224...230

Captures and displays Drive Status 2 bit pattern at the time of last fault.

Figure 54 - Status 2 @ Fault (228)

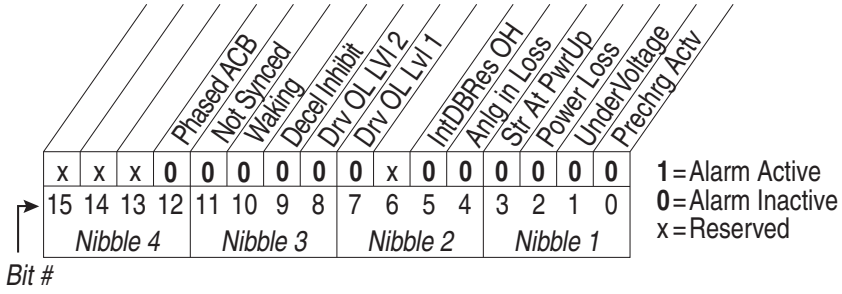


229 Alarm 1 @ Fault

Range:	See Figure 55
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	211, 224...230

Captures and displays Drive Alarm 1 at the time of the last fault.

Figure 55 - Alarm 1 @ Fault (229)

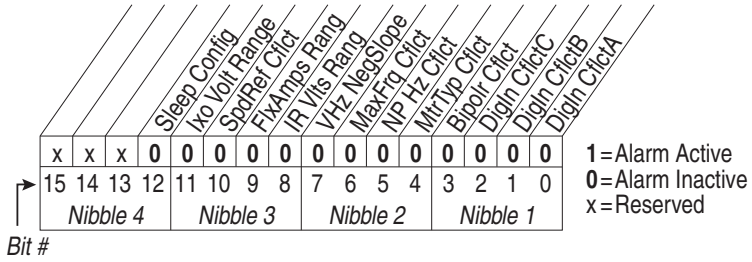


230 Alarm 2 @ Fault

Range:	See Figure 56
Default:	Read Only
Access:	1 **Path:** Utility > Diagnostics
See also:	211, 221...230

Captures and displays Drive Alarm 2 bit pattern at the time of last fault.

Figure 56 - Alarm 2 @ Fault (230)



234 Testpoint 1 Sel

Range:	0...65535 [1]	
Default:	499	
Access:	1	**Path:** Utility > Diagnostics
See also:	235	

Selects the function whose value is displayed in Testpoint 1 Data (235). These are internal values that are not accessible through parameters.

235 Testpoint 1 Data

32

Range:	0...4,294,697,295 [1]	
Default:	0	
Access:	1	**Path:** Utility > Diagnostics
See also:	234	

The present value of the function selected in Testpoint 1 Sel (234).

236 Testpoint 2 Sel

Range:	0...65535 [1]	
Default:	499	
Access:	1	**Path:** Utility > Diagnostics
See also:	237	

Selects the function whose value is displayed in Testpoint 2 Data (237). These are internal values that are not accessible through parameters.

237 Testpoint 2 Data

32

Range:	0...4,294,967,295 [1]	
Default:	0	
Access:	1	Path: Utility > Diagnostics
See also:	236	

The present value of the function selected in Testpoint 2 Sel (236).

238 Fault Config 1

Range: See Figure 57

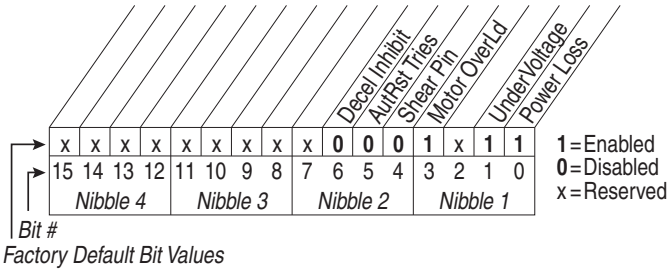
Default: See Figure 57

Access: 0 **Path:** Utility > Faults

See also:

Enables/disables annunciation of the faults shown in Figure 57.

Figure 57 - Fault Config 1 (238)



240 Fault Clear

Range: 0 = Ready
1 = Clear Faults
2 = Clr Flt Que

Default: 0 = Ready

Access: 1 **Path:** Utility > Faults

See also:

Resets a fault and clears the fault queue. After the fault clear operation is complete, this parameter returns to the value of 0 for **Ready**.

241 Fault Clear Mode

Range: 0 = Disabled
1 = Enabled

Default: 1 = Enabled

Access: 1 **Path:** Utility > Faults

See also:

Enables/disables a fault reset (clear faults) attempt from any source.

242 Power Up Marker

32

Range: 0.0000...4,294,967.2925 Hr [0.0001 Hr]

Default: Read Only

Access: 1 **Path:** Utility > Faults

See also: 244, 246, 248, 250, 252, 254, 256, 258

Accumulated hours that inverter had been powered up at the time of the most recent drive powerup.

This parameter is used along with the inverter fault timestamp parameters (Fault *n* Time parameters below) to determine whether a drive/inverter fault in the inverter fault queue happened before or after the most recent drive powerup.

This value rolls over to 0 after the drive has been powered on for more than the maximum value shown.

243 Fault 1 Code
245 Fault 2 Code
247 Fault 3 Code
249 Fault 4 Code
251 Fault 5 Code
253 Fault 6 Code
255 Fault 7 Code
257 Fault 8 Code

Range:	0000...65535
Default:	Read Only
Access:	1 **Path:** Utility > Faults
See also:	

A code that represents a drive fault. The codes appear in these parameters in the order they occur. Fault 1 Code = the most recent fault.

244 Fault 1 Time
246 Fault 2 Time
248 Fault 3 Time
250 Fault 4 Time
252 Fault 5 Time
254 Fault 6 Time
256 Fault 7 Time
258 Fault 8 Time

32

Range:	0.0000...429,496.7295 [0.0001 Hr]
Default:	Read Only
Access:	1 **Path:** Utility > Faults
See also:	242

The time between initial power up and the occurrence of the associated fault. Can be compared to Power Up Marker for the time from the most recent power up.

(Fault *n* Time) – (Power Up Marker) = the time difference to the most recent power up:

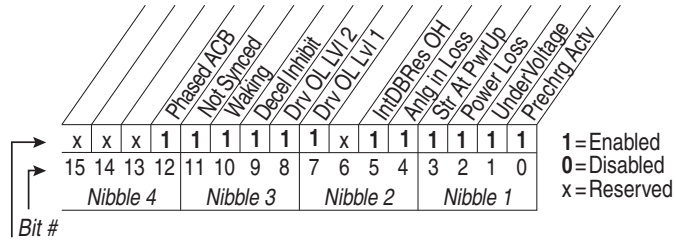
- A **negative value** indicates a fault occurred before the most recent power up.
- A **positive value** indicates a fault occurred after the most recent power up.

259 Alarm Config 1

Range: See Figure 58
Default: See Figure 58
Access: 1 **Path:** Utility > Alarms
See also:

Selects alarm conditions that initiate a drive alarm. See Chapter 10 for more information about alarms.

Figure 58 - Alarm Config 1 (259)



261 Alarm Clear

Range: 0 = Ready
1 = Clr Alarm Que
Default: 0 = Ready
Access: 1 **Path:** Utility > Alarms
See also: 262...269

Resets all Alarm1...8 Code parameters (262...269) to zero.

After a Clear Alarm Queue operation, the value of this parameter returns to 0 for **Ready**.

262 Alarm 1 Code
263 Alarm 2 Code
264 Alarm 3 Code
265 Alarm 4 Code
266 Alarm 5 Code
267 Alarm 6 Code
268 Alarm 7 Code
269 Alarm 8 Code

Range: 0...65535
Default: Read Only
Access: 1 **Path:** Utility > Alarms
See also: 261

A code that represents a drive alarm. The codes appear in the order that the alarms occur. The first code in is the first out. A time stamp is not available with alarms.

270 DPI Data Rate

Range: 0 = 125 kbps
1 = 500 kbps

Default: 1

Access: 1 **Path:** Communication > Comm Control

See also:

For LiquiFlo2.0 drives, this parameter **must** be set to 1 (500 kpbs).

271 Drive Logic Rslt

Range: See Figure 59

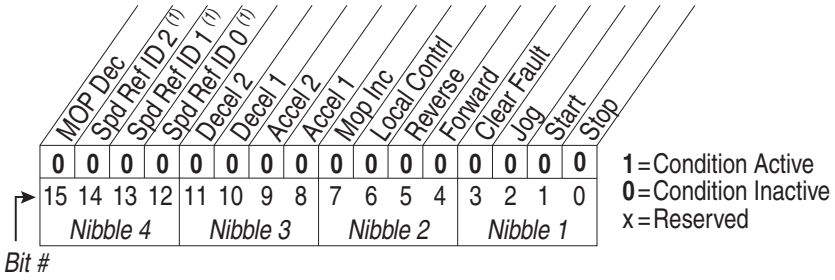
Default: Read Only

Access: 1 **Path:** Communication > Comm Control

See also:

The final logic command to the drive resulting from the combination of all port requests and masking functions. Each bit or set of bits represent a command to the drive or follower device.

Figure 59 - Drive Logic Rslt (271)



Bits(1)			Description
14	13	12	
0	0	0	No Command - Man. Mode
0	0	1	Ref A Auto
0	1	0	Preset 2 Auto
0	1	1	Preset 3 Auto
1	0	0	Preset 4 Auto
1	0	1	Preset 5 Auto
1	1	0	Preset 6 Auto
1	1	1	Preset 7 Auto

272 Drive Ref Rslt

Range: -/+32767 [1]
Default: Read Only
Access: 1 **Path:** Communication > Comm Control
See also:

Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the output prior to the accel/decel ramp and any corrections supplied by slip comp, PI, etc.

273 Drive Ramp Rslt

Range: -/+32767 [1]
Default: Read Only
Access: 1 **Path:** Communication > Comm Control
See also:

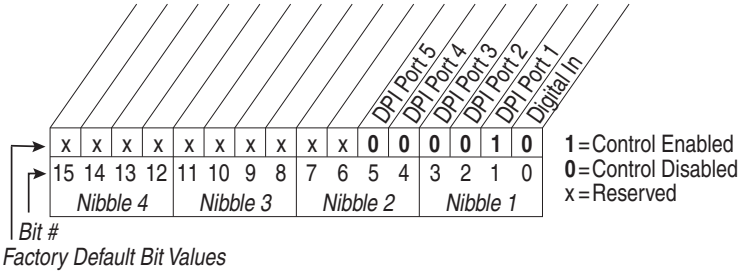
Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the value after the accel/decel ramp but prior to any corrections supplied by slip comp, PI, etc.

276 Logic Mask

Range: See Figure 60
Default: See Figure 60
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Enables and disables control of the drive by particular DPI devices or the digital inputs.

Figure 60 - Logic Mask (276)


DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 0 0 0 0 1 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Control Enabled
0 = Control Disabled
x = Reserved

277 Start Mask

Range: See Logic Mask (276)
Default: See Logic Mask (276)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

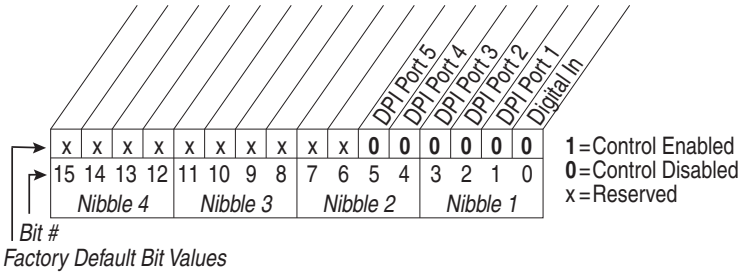
Controls which modules can issue start commands.

278 Jog Mask

Range: See Figure 61
Default: See Figure 61
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can issue jog commands.

Figure 61 - Jog Mask (278)


DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Control Enabled
0 = Control Disabled
x = Reserved
Factory Default Bit Values

279 Direction Mask

Range: See Jog Mask (278)
Default: See Jog Mask (278)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

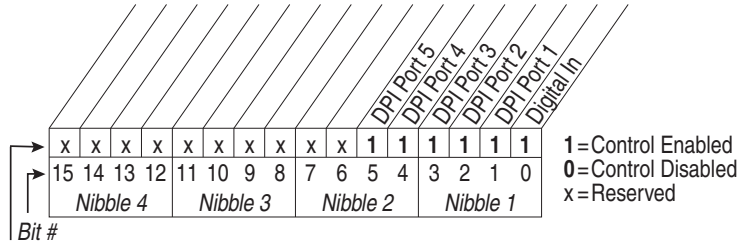
Controls which modules can issue forward/reverse direction commands.

280 Reference Mask

Range: See Figure 62
Default: See Figure 62
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can select an alternate reference. Speed Ref A, B Sel or Preset 1 - 7 (90, 93, 101...107).

Figure 62 - Reference Mask (280)


DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 1 1 1 1 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Control Enabled
0 = Control Disabled
x = Reserved

Factory Default Bit Values

281 Accel Mask

Range: See Reference Mask (280)
Default: See Reference Mask (280)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can select Accel Time 1, 2 (140, 141).

282 Decel Mask

Range: See Reference Mask (280)
Default: See Reference Mask (280)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can select Decel Time 1, 2. (142, 143)

283 Fault Clr Mask

Range: See Reference Mask (280)
Default: See Reference Mask (280)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can clear a fault.

284 MOP Mask

Range: See Reference Mask (280)
Default: See Reference Mask (280)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

Controls which modules can issue MOP commands to the drive.

285 Local Mask

Range: See Reference Mask (280)
Default: See Reference Mask (280)
Access: 1 **Path:** Communication > Masks & Owners
See also: 288...297

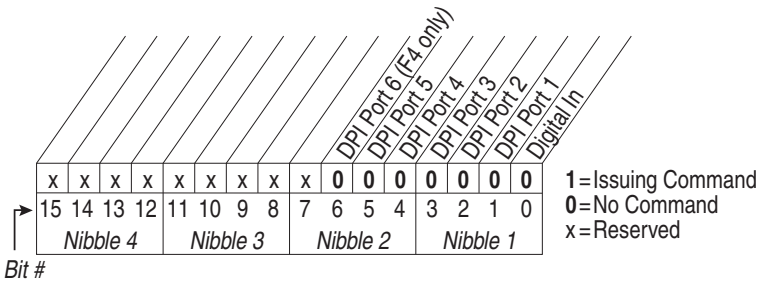
Controls which modules are allowed to take exclusive control of drive logic commands (except stop). Exclusive local control can be taken only when the drive is stopped.

288 Stop Owner

Range:	See Figure 63
Default:	Read Only
Access:	1 **Path:** Communication > Masks & Owners
See also:	276...285

Modules that are presently issuing a valid stop command.

Figure 63 - Stop Owner


DPI Port 6 (F4 only)
DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Issuing Command
0 = No Command
x = Reserved

289 Start Owner

Range:	See Stop Owner (288)
Default:	Read Only
Access:	1 **Path:** Communication > Masks & Owners
See also:	276...285

Modules that are presently issuing a valid start command.

290 Jog Owner

Range:	See Stop Owner (288)
Default:	Read Only
Access:	1 **Path:** Communication > Masks & Owners
See also:	276...285

Modules that are presently issuing a valid jog command.

291 Direction Owner

Range:	See Stop Owner (288)
Default:	Read Only
Access:	1 **Path:** Communication > Masks & Owners
See also:	276...285

Adapter that currently has exclusive control of direction changes.

292 Reference Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Adapter that currently has exclusive control of the command frequency source selection.

293 Accel Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Adapter that currently has exclusive control of selecting Accel Time 1, 2.

294 Decel Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Adapter that currently has exclusive control of selecting Decel Time 1, 2.

295 Fault Clr Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Adapter that is presently clearing a fault.

296 MOP Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Modules that are currently issuing increases or decreases in MOP command frequency.

297 Local Owner

Range: See Stop Owner (288)
Default: Read Only
Access: 1 **Path:** Communication > Masks & Owners
See also: 276...285

Adapter that has requested exclusive control of drive logic functions.

If an adapter is in local lockout, all other functions (except stop) on all other modules are locked out and non-functional. Local control is obtained only when the drive is stopped.

300 Data In A1 - Link A Word 1
301 Data In A2 - Link A Word 2

Range: 0...387 [1]
Default: 0 (Disabled)
Access: 1 **Path:** Communication > Datalinks
See also:

Parameter number whose value is written from a communications device data table.

Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type disables the link

Refer to the appropriate communications option board manual for datalink information.

302 Data In B1 - Link B Word 1
303 Data In B2 - Link B Word 2

Range: 0...387 [1]
Default: 0 (Disabled)
Access: 1 **Path:** Communication > Datalinks
See also:

Parameter number whose value is written from a communications device data table.

Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type disables the link.

Refer to the appropriate communications option board manual for datalink information.

304 **Data In C1** - Link C Word 1
305 **Data In C2** - Link C Word 2

Range:	0...387 [1]	
Default:	0 (Disabled)	
Access:	1	**Path:** Communication > Datalinks
See also:		

Parameter number whose value is written from a communications device data table.

Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type disables the link.

Refer to the appropriate communications option board manual for datalink information.

306 **Data In D1** - Link D Word 1
307 **Data In D2** - Link D Word 2

Range:	0...387 [1]	
Default:	306 = 34 307 = 35	
Access:	1	**Path:** Communication > Datalinks
See also:		

Parameter number whose value is written from a communications device data table.

Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type disables the link.

Refer to the appropriate communications option board manual for datalink information.

IMPORTANT In Liquiflo 2.0 drives, datalink D is used for inverter/rectifier communication. Do not change these two parameters.

310 **Data Out A1**- Link A Word 1
311 **Data Out A2** - Link A Word 2

Range:	0...387 [1]	
Default:	0 (Disabled)	
Access:	1	**Path:** Communication > Datalinks
See also:		

Parameter number whose value is written to a communications device data table.

312 **Data Out B1**- Link B Word 1
313 **Data Out B2** - Link B Word 2

Range: 0...387 [1]
Default: 0 (Disabled)
Access: 1 **Path:** Communication > Datalinks
See also:

Parameter number whose value is written to a communications device data table.

314 **Data Out C1**- Link C Word 1
315 **Data Out C2** - Link C Word 2

Range: 0...387 [1]
Default: 0 (Disabled)
Access: 1 **Path:** Communication > Datalinks
See also:

Parameter number whose value is written to a communications device data table.

316 **Data Out D1**- Link D Word 1
317 **Data Out D2** - Link D Word 2

Range: 0...387 [1]
Default: 316 = 33
317 = 218
Access: 1 **Path:** Communication > Datalinks
See also:

Parameter number whose value is written to a communications device data table.

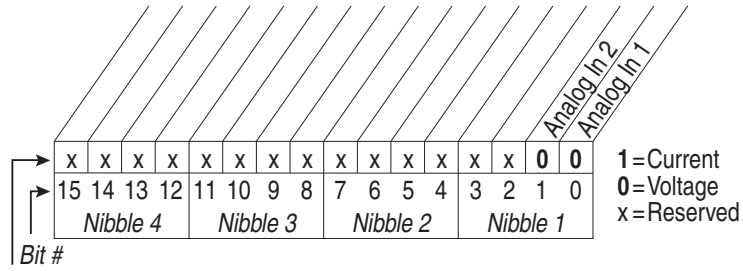
IMPORTANT In Liquiflo 2.0 drives, datalink D is used for inverter/rectifier communication. Do not change these two parameters.

320 **Anlg In Config**

Range: See Figure 64
Default: See Figure 64
Access: 0 **Path:** Inputs & Outputs > Analog Inputs
See also: 322, 323, 325, 326

Selects the type of input signal being used for user-configurable analog inputs 1 and 2.

Figure 64 - Anlg In Config (320)


Analog In 2
Analog In 1
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Current
0 = Voltage
x = Reserved
Factory Default Bit Values

For Frame 4 drives only (firmware version 2.x), the actual modes of the analog inputs depend on the value of this parameter and on the capabilities of the analog input hardware on the Combined I/O board. The units (V or mA) displayed for the **Analog In Hi** and **Analog In Lo** parameters are an accurate indication of the actual mode of the corresponding analog input if the input is physically present on the Combined I/O board.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

321 Anlg In Sqr Root

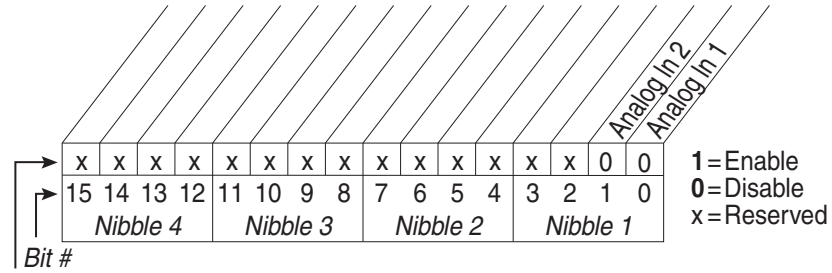
Range:	See Figure 65
Default:	See Figure 65
Access:	1 **Path:** Inputs & Outputs > Analog Inputs
See also:	320, 322, 323, 324, 325, 326, 327

Enables/disables the square root function for each user-configurable analog input.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

This function should be enabled if the input signal varies with the square of the quantity (for example, drive speed) being monitored. The square root function is scaled such that the input range is the same as the output range. For example, if the input is set up as a unipolar voltage input, then the input and output ranges of the square root function are 0...10 volts.

Figure 65 - Anlg in Sqr Root (321)


Analog In 2
Analog In 1
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Enable
0 = Disable
x = Reserved

Factory Default Bit Values

322 Analog In 1 Hi

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	20.000 mA
Access:	0 **Path:** Inputs & Outputs > Analog Inputs
See also:	91, 92, 320

The drive scales the value read from the user-configurable analog input and converts it to units usable for the application. You control the scaling by setting parameters that associate a low and high point in the input range with a low and high point in the target range.

Analog In 1 Hi sets the highest input value to the user-configurable analog input 1 scaling block. See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Analog Input Scaling Example

Assume:

Speed Ref A Sel = Analog In 1

Minimum Freq = 0 Hz

Maximum Freq = 60 Hz

Analog In 1 Lo = 0.0V

Analog In 1 Hi = 10.0V

This is the default setting, where minimum input (0V) represents Minimum Speed and maximum input (10V) represents Maximum Speed.

323 Analog In 1 Lo

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	4 mA
Access:	0 **Path:** Inputs & Outputs > Analog Inputs
See also:	91, 92, 320

Sets the lowest input value to the user-configurable analog input 1 scaling block. See Analog In 1 Hi (322) for more information and a scaling example.

Analog In 1 Hi sets the highest input value to the user-configurable analog input 1 scaling block. See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

324 Analog In 1 Loss

Range:	0 = Disabled 1 = Fault 2 = Hold Input (use last frequency command) 3 = Set Input Lo (use Minimum Speed as frequency command) 4 = Set Input Hi (use Maximum Speed as frequency command) 5 = Goto Preset1 (use Preset 1 as frequency command) 6 = Hold OutFreq (maintain last output frequency)
Default:	0 = Disabled
Access:	1 Path: Inputs & Outputs > Analog Inputs
See also:	91, 92, 320

Selects drive response when an analog signal loss is detected on user-configurable analog input 1:

- 1.0V = signal loss
- 1.5V = end of signal loss
- 2.0 mA = signal loss
- 3.0 mA = end of signal loss

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 324 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive ramps to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

IMPORTANT Note that there is no signal loss detection while the input is in bipolar voltage mode.

325 Analog In 2 Hi

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	10V
Access:	0 **Path:** Inputs & Outputs > Analog Inputs
See also:	91, 92, 320, 326, 327

Sets the highest value to the user-configurable analog input 2 scaling block.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

326 Analog In 2 Lo

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	0.000V
Access:	0 **Path:** Inputs & Outputs > Analog Inputs
See also:	91, 92, 320, 326, 327

Sets the lowest input value to the user-configurable analog input 2 scaling block.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

327 Analog In 2 Loss

Range:	0 = Disabled 1 = Fault 2 = Hold Input (use last frequency command) 3 = Set Input Lo (use Minimum Speed as frequency command) 4 = Set Input Hi (use Maximum Speed as frequency command) 5 = Goto Preset1 (use Preset1 as frequency command) 6 = Hold OutFreq (maintain last output frequency)
Default:	0 = Disabled
Access:	1 **Path:** Inputs & Outputs > Analog Inputs
See also:	91, 92, 320, 326, 327

Selects drive action when an analog signal loss is detected on user-configurable analog input 2:

- 1.0V = signal loss
- 1.5V = end of signal loss
- 2.0 mA = signal loss
- 3.0 mA = end of signal loss

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 327 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive ramps to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

IMPORTANT Note that there is no signal loss detection while the input is in bipolar voltage mode.

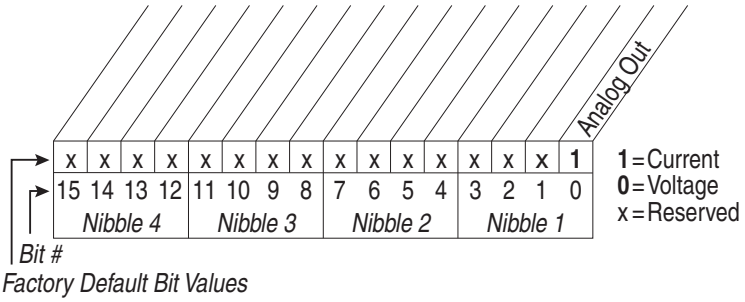
340 Anlg Out Config

Range:	See Figure 66
Default:	1
Access:	1 **Path:** Inputs & Outputs > Analog Outputs
See also:	

Selects the mode for the user-configurable analog output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Figure 66 - Anlg Out Config (340)


Analog Out
x x x x x x x x x x x x x x x 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Current
0 = Voltage
x = Reserved

Factory Default Bit Values

For Frame 4 drives only (firmware versions 2.x), the actual mode of the user-configurable analog output depends on the value of this parameter and on the capabilities of the analog output hardware on the Combined I/O board. The units (V or mA) displayed for the **Analog Out Hi** and **Analog Out Lo** parameters are an accurate indication of the actual mode of the analog output.

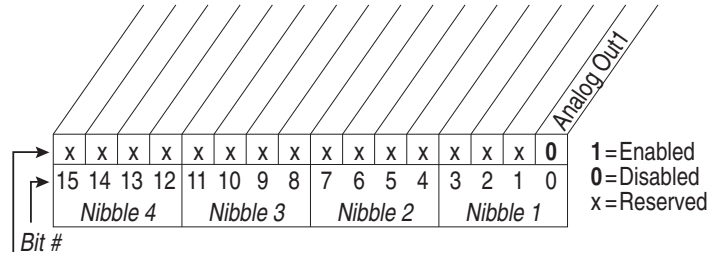
341 Anlg Out Absolut

Range:	See Figure 67
Default:	See Figure 67
Access:	1 **Path:** Inputs & Outputs > Analog Outputs
See also:	342

Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the user-configurable analog output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Figure 67 - Anlg Out Absolute (341)


Analog Out1
x x x x x x x x x x x x x x x 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Enabled
0 = Disabled
x = Reserved

Factory Default Bit Values

342 Analog Out1 Sel

Range:	0 = Output Freq 1 = Command Freq 2 = Output Amps 3 = Torque Amps 4 = Flux Amps 5 = Output Power 6 = Output Volts 7 = DC Bus Volts 8 = PI Reference 9 = PI Feedback 10 = PI Error 11 = PI Output 12 = %Motor OL 13 = %Drive OL 14 = Application
Default:	14 = Application
Access:	0 **Path:** Inputs & Outputs > Analog Outputs
See also:	1...7, 12, 135...138, 219, 220

Selects the source of the value that drives the user-configurable analog output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

343 Analog Out1 Hi

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	20.0 mA
Access:	0 **Path:** Inputs & Outputs > Analog Outputs
See also:	31, 342

Sets the user-configurable analog output value when the source value is at maximum.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Scaling the User-configurable Analog Output

You define the scaling for the analog output by entering analog output voltages into Analog Out1 Lo and Analog Out1 Hi. These two output voltages correspond to the bottom and top of the possible range covered by the quantity being output. The output voltage varies linearly with the quantity being output. The analog output voltage does not go outside the limits defined by Analog Out1 Lo and Analog Out 1 Hi. See Table 8.

Table 8 - Analog Output Scaling

Options		Analog Out1 Lo Value Corresponds to:		Analog Out 1 Hi (343) Value Corresponds to:
		Analog Out Absolut (341) = Disabled	Analog Out Absolut (341) = Enabled	
0	Output Freq	–[Maximum Freq]	0 Hz	+[Maximum Freq]
1	Commanded Freq	–[Maximum Speed]	0 Hz	+[Maximum Speed]
2	Output Amps	0 Amps	0 Amps	200% Rated
3	Torque Amps	–200% Rated	0 Amps	200% Rated
4	Flux Amps	0 Amps	0 Amps	200% Rated
5	Output Power	0 kW	0 kW	200% Rated
6	Output Volts	0 Volts	0 Volts	120% Rated
7	DC Bus Volts	0 Volts	0 Volts	200% Rated
8	PI Reference	–100%	0%	100%
9	PI Feedback	–100%	0%	100%
10	PI Error	–100%	0%	100%
11	PI Output	–100%	0%	100%
12	%Motor OL	0%	0%	100%
13	%Drive OL	0%	0%	100%
14	Application	see below	see below	see below

If Analog Out1 Sel (342) is set to **Application** (14), and the drive is a Frame 3 drive (firmware version 1.x), then the source of the analog output value is the value in Appl Analog Out (31), and the values entered in that parameter can range from 4.000 mA (resulting in an analog output level corresponding to Analog Out1 Lo) to 20.000 mA (resulting in an analog output level corresponding to Analog Out1 Hi).

If Analog Out1 Sel (342) is set to **Application** (14), and the drive is a Frame 4 drive (firmware version 2.x), then the value entered in Appl Analog Out (31) is output directly on the analog output, irrespective of the values of Analog Out1 Hi (343) and Analog Out1 Lo (344).

344 Analog Out1 Lo

Range:	4.000...20.000 mA [0.001 mA] -/+10.000V [0.1V] 0.0...10.000V [0.1V]
Default:	4.0 mA
Access:	0 **Path:** Inputs & Outputs > Analog Outputs
See also:	31, 342, 343

Sets the user-configurable analog output value when the source value is at minimum. See Analog Out1 Hi (343) for more information. See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

345 Inv IGBT Tmp Top

Range:	-3276.8...3276.7 °C
Default:	Read Only
Access:	1 **Path:** Inputs & Outputs > Temperature etc
See also:	346, 347, 348

Displays the measured temperature of the top inverter IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

346 Inv IGBT Tmp Up

Range:	-3276.8...3276.7 °C
Default:	Read Only
Access:	1 **Path:** Inputs & Outputs > Temperature etc
See also:	345, 347, 348

Displays the measured temperature of the upper inverter IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

347 Inv IGBT Tmp Low

Range:	-3276.8...3276.7 °C
Default:	Read Only
Access:	1 **Path:** Inputs & Outputs > Temperature etc
See also:	345, 346, 348

Displays the measured temperature of the lower inverter IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

348 Inv IGBT Tmp Bot

Range: -3276.8...3276.7 °C
Default: Read Only
Access: 1 **Path:** Inputs & Outputs > Temperature etc
See also: 345, 346, 347

Displays the measured temperature of the bottom inverter IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

349 Inv Coldplt Tmp

Range: -3276.8...3276.7 °C
Default: Read Only
Access: 1 **Path:** Inputs & Outputs > Temperature etc
See also:

Displays the measured inverter coldplate temperature in degrees C. This parameter is only usable if a coldplate temperature sensor is installed in the drive.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

350 Inv Ambient Tmp

Range: -3276.8...3276.7 °C
Default: Read Only
Access: 1 **Path:** Inputs & Outputs > Temperature etc
See also:

Displays the measured ambient temperature of the drive in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

351 Inv PS Tmp

Range: -3276.8...3276.7 °C
Default: Read Only
Access: 1 **Path:** Inputs & Outputs > Temperature etc
See also:

Displays the measured drive power supply temperature in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

352 Inv PS +12

Range: -3276.8V...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage of the +12V power supply.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

353 Inv PS -12V

Range: -3276.8V...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage of the -12V power supply.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

354 Inv I/O ID V

Range: -3276.8V...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage that identifies which type of Comblined I/O board is installed.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

361 Digital In1 Sel
362 Digital In2 Sel
363 Digital In3 Sel
364 Digital In4 Sel
365 Digital In5 Sel
366 Digital In6 Sel

Range: 0 = Not Used
1 = Enable
2 = Clear Faults(1)
3 = Aux Fault
4 = Stop - CF(2)
5 = Start
6 = Fwd/Reverse2
7 = Run(3)
8 = Run Forward3
9 = Run Reverse3
10 = Jog
11 = Jog Forward
12 = Jog Reverse
13 = Stop Mode B
14 = Bus Reg Md B
15 = Speed Sel 1(4)
16 = Speed Sel 24
17 = Speed Sel 34
18 = Auto/Manual
19 = Local
20 = Acc2 & Dec2
21 = Accel 2
22 = Decel 2
23 = MOP Inc
24 = MOP Dec
25 = Excl Link
26 = PI Enable
27 = PI Hold
28 = PI Reset
29 = Pwr Loss Lvl
30 = Precharge En

Default: See Table 10

Access: 361...366 = 0 **Path:** Inputs & Outputs > Digital Inputs

See also: 96, 100, 124, 140, 156, 162, 194, 380

(1) When Digital In"x" Sel is set to option 2 (Clear Faults), the stop key cannot be used to clear a fault condition.
(2) Typical 3-Wire Inputs. These require that only 3-wire functions are chosen. Including 2-wire selections causes a type 2 alarm.
(3) Typical 2-Wire Inputs. These require that only 2-wire functions are chosen. Including 3-wire selections causes a type 2 alarm.
(4) To access Preset Speed 1, set Speed Ref A Sel to Preset Speed 1. See Table 9.

Table 9 - Speed Select Inputs

Speed Select Inputs			
3	2	1	Reference Source
0	0	0	Speed Ref A Sel
0	0	1	Speed Ref B Sel
0	1	0	Preset Speed 2
0	1	1	Preset Speed 3
1	0	0	Preset Speed 4
1	0	1	Preset Speed 5
1	1	0	Preset Speed 6
1	1	1	Preset Speed 7

Assigns an input function to the user-configurable digital inputs of the drive. Note that digital inputs Run, Jog, Clear-Faults, and Direction control functions are operational only when the mask parameters are set for these functions.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Table 10 - Default Values for Parameters 361...366

Parameter No.	Default Value
361	0 = Unused
362	0 = Unused
363	0 = Unused
364	0 = Unused
365	0 = Unused
366	0 = Unused

The input functions are:

1 = Enable: If the input is closed, the drive can run (start permissive). If the input is open, the drive will not start.

If the drive is already running when this input is opened, the drive coasts and indicates **not enabled** on the OIM (if present). This is not considered a fault condition, and no fault is generated.

If multiple enable inputs are configured, the drive will not run if any of them are open.

2 = Clear Faults: This function allows an external device to reset drive faults through the terminal block if clearing faults from the terminal block is enabled using the Logic Mask (276) and Fault Clr Mask (283). An open-to-closed transition on this input resets the current fault (if any).

If this input is configured at the same time as Stop-Clear Faults, then only the Clear Faults input can actually cause faults to be reset.

3 = Aux Fault: If the input is open, an Auxiliary Input fault (fault 2) is generated. The Aux Fault Input Function is active at all times regardless of the selected logic control source.

IMPORTANT The Aux Fault input function is not intended for a fast output power kill. The drive will not fault until the software detects the change of state of this input. If this input function is not configured, the fault will not occur.

4 = Stop - CF (Stop - Clear Faults): An open input always asserts a stop command. While the stop is asserted, the drive ready status is off. A closed input allows the drive to start. An open-to-closed transition is interpreted as a clear faults request. The drive clears any existing faults.

If Start is configured, then Stop - Clear Faults must also be configured to prevent a digital input configuration alarm condition. Stop - Clear Faults is optional in all other circumstances.

5 = Start: An open-to-closed transition generates a run command if start from the terminal block is enabled via the Logic Mask (276) and Start Mask (277).

If Start is configured, then Stop - Clear Faults must also be configured to prevent a digital input configuration alarm condition.

6 = Fwd/Reverse (Forward/Reverse): An open input sets the direction to forward if direction control from the terminal block is enabled via the Logic Mask (276) and Direction Mask (279). A closed input sets the direction to reverse. If the state of the input changes and the drive is running or jogging, the drive changes direction.

If the Fwd/Rev input function is assigned to more than one physical digital input at a time, a digital input configuration alarm is asserted.

7 = Run: An open-to-closed transition on this input generates a a run command if start from the terminal block is enabled via the Logic Mask (276) and Start Mask (277). If the input is open, the drive will stop.

The purpose of this input function is to allow a 2-wire start while the direction is being controlled by some other function.

8 and **9 = Run Forward** and **Run Reverse:** If start and direction control from the terminal block are enabled via the Logic Mask (276), Start Mask (277), and Direction Mask (279), an open-to-closed transition on one or both inputs while the drive is stopped causes the drive to run unless the Stop - Clear Faults input function is configured and open.

If one or both of these input functions are assigned to more than one physical digital input at a time, a digital input configuration alarm is asserted.

10 = Jog: An open-to-closed transition on this input while the drive is stopped causes the drive to start (jog) in the current direction. When the input opens while the drive is running (jogging), the drive stops.

ATTENTION: If a normal drive start command is received while the drive is jogging, the drive switches from jog mode to run mode. The drive does not stop, but may change speed and/or change direction. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive does not jog while running or while the Stop - Clear Faults input is open. Start has precedence over jog.

11 and **12 = Jog Forward** and **Jog Reverse:** An open-to-closed transition on one or both inputs while the drive is stopped causes the drive to jog unless the Stop - Clear Faults input function is configured and open. Table 11 describes the actions taken by the drive in response to various states of these input functions.

Table 11 - Drive Response to Jog Forward and Jog Reverse Inputs

Jog Forward	Jog Reverse	Drive Response
Open	Open	Drive will stop if already jogging, but can be started by other means.
Open	Closed	Drive jogs in reverse direction.
Closed	Open	Drive jogs in forward direction.
Closed	Closed	Drive continues to jog in current direction.

ATTENTION: If a normal drive start command is received while the drive is jogging, the drive will switch from jog mode to run mode. The drive will not stop, but may change speed and/or change direction. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive will not jog while running or while the Stop - Clear Faults input is open. Start has precedence over jog.

If one of these input functions is configured and the other one is not, Table 11 still applies, but consider the unconfigured input function permanently open.

13 = Stop Mode B: This digital input selects between two different drive stop modes.

If the input is open, then Stop Mode A selects which stop mode to use. If the input is closed, the Stop Mode B selects which stop mode to use. If this input function is not configured, then Stop Mode A selects which stop mode to use.

14 = Bus Regulation Mode B: This digital input function selects how the drive regulates excess voltage on the DC bus.

If the input is open, then Bus Reg Mode A selects which bus regulation mode to use. If the input is closed, then Bus Reg Mode B selects which bus regulation

mode to use. If this input function is not configured, then Bus Reg Mode A selects which bus regulation mode to use.

15...17 = Speed Select 1, 2, 3: One, two, or three digital input functions can be used to select the speed reference used by the drive, and they are called the Speed Select input functions. The current open/closed state of all Speed Select input functions combine to select which source is the current speed reference.

There are seven possible combinations of open/closed states for the three input functions, and thus seven possible parameters can be selected. The seven parameters are: Speed Ref A Sel and Preset Speed 2 through Preset Speed 7.

If the Speed Select input functions select Speed Ref A Sel, then the value of that parameter further selects a reference source. There are a large number of possible selections, including all six presets.

If the input functions directly select one of the preset speed parameters, then the parameter contains a frequency that is to be used as the reference.

The Speed Select input function configuration process involves assigning the functionality of the three possible Speed Select input functions to physical digital inputs. The three Speed Select inputs functions are called Speed Select 1, Speed Select 2, and Speed Select 3, and they are assigned to physical inputs using the Digital In“x” Sel parameters.

Table 12 describes the various reference sources that can be selected using all three of the Speed Select input functions. If any of the three Reference Select input functions are not configured, the software still follows the table, but treats the unconfigured inputs as if they are permanently open.

Table 12 - Effect of Speed Select Input State on Selected Reference

Speed Select 3	Speed Select 2	Speed Select 1	Parameter that determines reference:
Open	Open	Open	Speed Ref A Sel
Open	Open	Closed	Speed Ref B Sel
Open	Closed	Open	Preset Speed 2
Open	Closed	Closed	Preset Speed 3
Closed	Open	Open	Preset Speed 4
Closed	Open	Closed	Preset Speed 5
Closed	Closed	Open	Preset Speed 6
Closed	Closed	Closed	Preset Speed 7

18 = Auto/Manual: The Auto/Manual function allows a single control device to assume exclusive control of reference select. The most recent peripheral (OIM or terminal block) that makes a manual reference request is given control of the reference.

If the Auto/Manual input function is closed, then the drive uses one of the analog inputs (defined by TB Man Ref Sel) as the reference. If an OIM subsequently

requests manual control (that is, Auto/Man F-Key is pressed) and then gives control up (presses Auto/Man F-Key again), then the Auto/Manual digital input must be opened and closed again to regain control of the manual reference.

If this input is open, then the terminal block does not request manual control of the reference. If no control device (including the terminal block) is currently requesting manual control of the reference, then the drive uses the normal reference selection mechanisms.

19 = Local

20 = Acc2 & Dec2: A single input function is used to select between Accel Time 1/Decel Time 1 and Accel Time 2/Decel Time2.

If the function is open, the drive uses Accel Time 1 as the acceleration rate and Decel Time 1 as the deceleration rate. If the function is closed, the drive uses Accel Time 2 as the acceleration rate and Decel Time 2 as the deceleration rate.

21, 22 = Accel 2, Decel 2: One input function (called Accel 2) selects between Accel Time 1 and Accel Time 2, and another input function (called Decel 2) selects between Decel Time 1 and Decel Time 2. The open state of the function selects Accel Time 1 or Decel Time 1, and the closed state selects Accel Time 2 or Decel Time 2.

23, 24 = MOP Increment, MOP Decrement: The MOP is a reference setpoint (called the MOP Value) that can be incremented and decremented by external devices. These input functions are used to increment and decrement the Motor Operated Potentiometer (MOP) value inside the drive. The MOP value is retained through a power cycle. The current MOP value is visible in inverter parameter MOP Frequency (11).

- While the MOP Increment input is closed, the MOP value increases at rate contained in MOP Rate (195). Units for rate are Hz per second.
- While the MOP Decrement input is closed, MOP value decreases at rate contained in MOP Rate (195). Units for rate are Hz per second.
- If both the MOP Increment and MOP Decrement inputs are closed, the MOP value stays the same.
- In order for the drive to use the MOP value as the current speed reference, either Speed Ref A Sel must be set to MOP.

25 = Excl Link: The state of this input is passed through to the **Input x Link** function of a digital output. See inverter parameters 380...387.

26 = PI Enable: If this input function is closed, the operation of the Process PI loop is enabled.

If this input function is open, the operation of the Process PI loop is disabled.

27 = PI Hold: If this input function is closed, the integrator for the Process PI loop is held at the current value; that is, it does not increase.

If this input function is open, the integrator for the Process PI loop is allowed to increase.

28 = PI Reset: If this input function is closed, the integrator for the Process PI loop is reset to 0.

If this input function is open, the integrator for the Process PI loop integrates normally.

29 = Pwr Loss Lvl: Do not select the **Pwr Loss Lvl** input function in Liquiflo 2.0 drives.

30 = Precharg En: This input function is used to manage disconnection from a common DC bus. **Do not** select the **Precharg En** input function in Liquiflo 2.0 drives.

Type 2 Alarms

Some digital input programming may cause conflicts that result in a Type 2 alarm. For example, Digital In1 Sel set to 5 (Start) in 3-wire control, and Digital In2 Sel set to 7 (Run) in 2-wire control. See Chapter 10 for more information about these alarms.

Dig In Status (116) indicates the current state of the digital inputs.

380 Digital Out1 Sel

Range:	1 = Fault (De-energized = Fault, Energized = No Fault) 2 = Alarm (De-energized = Inverter Alarm, Energized = No Inverter Alarm) 3 = Ready 4 = Run 5 = Forward Run 6 = Reverse Run 7 = Auto Restart 8 = Powerup Run 9 = At Speed 10 = At Freq 11 = At Current 12 = At Torque 13 = At Temp 14 = At Bus Volts 15 = At PI Error 16 = DC Braking 17 = Curr Limit 18 = Economize 19 = Motor Overld 20 = Power Loss 21 = Input 1 Link 22 = Input 2 Link 23 = Input 3 Link 24 = Input 4 Link 25 = Input 5 Link 26 = Input 6 Link 27 = Shunt Trip 28 = Aux Run
Default:	27 = Shunt Trip
Access:	0 **Path:** Inputs & Outputs > Digital Outputs
See also:	1...4, 12, 48, 53, 137, 147, 157, 184, 218, 381...383, 385, 386

Selects the drive status that will energize user-configurable digital output 1.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

For Frame 3 drives (firmware version 1.x), most of the values possible for this parameter only affect the operation of the drive if an optional Standard I/O board is present.

The only exception is when Dig Out1 Sel (380) is set to **Aux Run** (28). If the parameter is set to **Aux Run** (28), digital output 2 on the AC Line I/O board is energized whenever the inverter is running, even if an optional Standard I/O board is not present.

381 Dig Out1 Level

Range:	0.0...819.2 [0.1]
Default:	0.0
Access:	0 **Path:** Inputs & Outputs > Digital Outputs
See also:	380

Sets the user-configurable digital output activation level for options 10...15 in Digital Out1 Sel. Units are assumed to match the above selection (for example, At Freq = Hz, At Torque = Amps).

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

382 Dig Out1 OnTime

Range:	0.00...600.00 sec [0.01 sec]
Default:	0.00 sec
Access:	1 **Path:** Inputs & Outputs > Digital Outputs
See also:	380

Sets the on delay time for user-configurable digital output 1. This is the time between the occurrence of a condition and activation of the user-configurable digital output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

383 Dig Out1 OffTime

Range:	0.00...600.00 sec [0.01 sec]
Default:	0.00 sec
Access:	1 **Path:** Inputs & Outputs > Digital Outputs
See also:	380

Sets the off delay time for user-configurable digital output 1. This is the time between the disappearance of a condition and de-activation of the user-configurable digital output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

384 Digital Out2 Sel

Range:	1 = Fault (De-energized = Fault, Energized = No Fault) 2 = Alarm (De-energized = Inverter Alarm, Energized = No Inverter Alarm) 3 = Ready 4 = Run 5 = Forward Run 6 = Reverse Run 7 = Auto Restart 8 = Powerup Run 9 = At Speed 10 = At Freq 11 = At Current 12 = At Torque 13 = At Temp 14 = At Bus Volts 15 = At PI Error 16 = DC Braking 17 = Curr Limit 18 = Economize 19 = Motor Overld 20 = Power Loss 21 = Input 1 Link 22 = Input 2 Link 23 = Input 3 Link 24 = Input 4 Link 25 = Input 5 Link 26 = Input 6 Link 27 = Shunt Trip 28 = Aux Run
Default:	4 = Run
Access:	0 **Path:** Inputs & Output > Digital Outputs
See also:	1...4, 12, 48, 53, 137, 147, 157, 184, 218, 381...383, 385, 386

Selects the drive status that will energize user-configurable digital output 2.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

385 Dig Out2 Level

Range:	0.0...819.2 [0.1]
Default:	0.0
Access:	0 **Path:** Inputs & Output > Digital Outputs
See also:	384

Sets the user-configurable digital output activation level for options 10...15 in Digital Out2 Sel. Units are assumed to match the above selection (for example, At Freq = Hz, At Torque = Amps).

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

386 Dig Out2 OnTime

Range:	0.00...600.00 sec [0.01 sec]	
Default:	0.00 sec	
Access:	1	**Path:** Inputs & Output > Digital Outputs
See also:	384	

Sets the on delay time for the user-configurable digital output 2. This is the time between the occurrence of a condition and activation of the digital output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

387 Dig Out2 OffTime

Range:	0.00...600.00 sec [0.01 sec]	
Default:	0.00 sec	
Access:	1	**Path:** Inputs & Output > Digital Outputs
See also:	384	

Sets the off delay time for inverter digital output 2. This is the time between the disappearance of a condition and de-activation of the digital output.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the inverter.

Rectifier Parameters

1 Line Frequency

Range:	0.0...63.0 Hz [0.1 Hz]	
Default:	Read Only	
Access:	0	**Path:** Monitor > Metering
See also:		

The input line frequency is displayed as *x.x* Hz.

2 Input Current R

Range:	0.0...3276.7 A [0.1 A]	
Default:	Read Only	
Access:	0	**Path:** Monitor > Metering
See also:		

The RMS input phase current I*r* is displayed as *x.x* A.

3 Input Current S

Range: 0.0...3276.7 A [0.1 A]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The RMS input phase current I*s* is displayed as *x.x* A.

4 Input Current T

Range: 0.0...3276.7 A [0.1 A]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The RMS input phase current I*t* is displayed as *x.x* A.

5 Active Current

Range: ±3276.7 A [0.1 A]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The active input current is displayed as ±*x.x* A. Motoring current is positive and generating current is negative.

6 Reactive Current

Range: 0.0...3276.7 A [0.1 A]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The reactive input current is displayed as *x.x* A. This value should always be near 0.

7 Input Voltage RS

Range: 0.0...3276.7 V AC [0.1V AC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The RMS phase-to-phase input voltage V*rs* is displayed as *x.x* V.

8 Input Voltage ST

Range: 0.0...3276.7 V AC [0.1V AC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The RMS phase-to-phase input voltage V*st* is displayed as *x.x* V.

9 Input Voltage TR

Range: 0.0...3276.7 V AC [0.1V AC]
Default: Read Only
Access: 0 Path: Monitor > Metering
See also:

The RMS phase-to-phase input voltage V*tr* is displayed as *x.x* V.

10 DC Bus Voltage

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The DC bus voltage is displayed as *x.x* V.

11 Active Voltage

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The commanded active input voltage is displayed as *x.x* V DC.

12 Reactive Voltage

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The commanded reactive input voltage is displayed as *x.x* V DC.

13 Input kW

Range: ± 2400.0 kW [0.1 kW]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The input power is displayed as *x.x* kW. Motoring power is positive and generating power is negative.

14 Input Pwr Factor

Range: 0.00...2.00 [0.01]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The input power factor is displayed as 1.00 for unity. Values greater than 1 indicate leading power factor.

15 Motoring kWh

Range: 0.0...429496729.5 kWh [0.1 kWh]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The elapsed kWh consumed is displayed as *x.x* kWh. This parameter is reset through the Reset Meters (200) parameter.

16 Regen kWh

Range: 0.0...429496729.5 kWh [0.1 kWh]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The elapsed kWh consumed is displayed as *x.x* kWh. This parameter is reset through the Reset Meters (200) parameter.

17 Elapsed Run Time

Range: 0.0...429496729.5 hour [0.1 hour]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The elapsed run time is displayed as *x.x* hours. This parameter is reset through the Reset Meters (200) parameter.

18 Rctfr Base Temp

Range: -20.0...120.0 °C [0.1 °C]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The hottest measured rectifier IGBT module temperature is displayed as *x.x* degrees C.

19 Rctfr IGBT Temp

Range: -20.0...120.0 °C [0.1 °C]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The calculated rectifier IGBT junction temperature is displayed as *x.x* degrees C.

20 Rctfr IT Overld

Range: 0.0...100.0% [0.1%]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also:

The rectifier IT overload calculation is displayed as *x.x*% where the value of 100.0 is the point where the Rectifier IT Overload fault (fault 219) is generated.

21 Rctfr I2T Overld

Range: 0.0...100.0% [0.1%]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also: 106

The rectifier I^2T overload is displayed as *x.x*% where the value of 100.0 is the point where the rectifier I2T overload fault (fault 220) is generated.

22 Line I Imbalance

Range: 0.0...100.0% [0.1%]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also: 2, 3, 4, 62, 63

The imbalance in input phase current is displayed as *x.x*%.

The imbalance in amps is calculated as the larger of:

(largest phase current) – (average phase current), or

(average phase current) – (smallest phase current).

The imbalance in percent is calculated as:

(Imbalance in amps) ÷ (average phase current) x 100.

23 Line V Imbalance

Range: 0.0...100.0% [0.1%]
Default: Read Only
Access: 0 **Path:** Monitor > Metering
See also: 7, 8, 9, 60, 61

The imbalance in input phase voltage is displayed as *x.x*%.

The imbalance in volts is calculated as the larger of:

(largest phase to phase voltage) – (average phase to phase voltage), or

(average phase to phase voltage) – (smallest phase to phase voltage).

The imbalance in percent is calculated as:

(Imbalance in volts) ÷ (average phase to phase voltage) x 100.

26 Rated kW

Range: 0.00...3000.0 kW [x.xx kW]
Default: Read Only
Access: 0 **Path:** Monitor > Drive Data
See also:

The rectifier rated kW is displayed as *x.xx* kW.

27 Rated Volts

Range	0.0...6553.5 V AC [0.1V AC]
Default:	Read Only
Access:	0 **Path:** Monitor > Drive Data
See also:	

The rectifier rated RMS input voltage is displayed as *x.x* V AC.

28 Rated Amps

Range:	0.0...6553.5 A [0.1 A]
Default:	Read Only
Access:	0 **Path:** Monitor > Drive Data
See also:	

The rectifier rated RMS input current is displayed as *x.x* A.

29 Control SW Ver

Range:	x.xxx
Default:	Read Only
Access:	0 **Path:** Monitor > Drive Data
See also:	

The rectifier software version number is displayed as *x.xxx*.

60 V Imbalance Lmt

Range:	**Path:** 0.0 to 20.0% [0.1%]
Default:	10.0
Access:	0 **Path:** Configuration > AC Line
See also:	23, 61

The allowed level of imbalance in input voltage entered as *x.x*%.

61 V Imbalance Time

Range:	1.0...10.0 seconds [0.1 seconds]
Default:	1.0
Access:	0 **Path:** Configuration > AC Line
See also:	23, 60

An Input V Imbalance fault (fault 226) is generated if Line V Imbalance (23) is greater than V Imbalance Lmt (60) for this amount of time.

62 I Imbalance Lmt

Range:	0.0...40.0% [0.1%]
Default:	30.0
Access:	0 **Path:** Configuration > AC Line
See also:	22, 63

The allowed level of imbalance in input current entered as *x.x*%.

63 I Imbalance Time

Range:	1.0 to10.0 seconds [0.1 seconds]
Default:	10.0
Access:	0 **Path:** Configuration > AC Line
See also:	22, 62

An Input I Imbalance fault (fault 225) is generated if Line I Imbalance (22) is greater than I Imbalance Limit (62) for this amount of time.

64 Ride Through Ena

Range:	0 = Disabled 1 = Enabled
Default:	0 = Disabled
Access:	0 **Path:** Configuration > AC Line
See also:	65, inverter 184, 185

If Ride Through Ena (64) is set to **Disabled**, then any interruption in input power or AC line synchronization causes an immediate AC Line Lost fault (fault 227).

If Ride Through Ena (64) is set to **Enabled**, then any interruption in input power or AC line synchronization causes the rectifier to enter its standby state and start its ride through timer. If the ride through timer expires before the input/synchronization loss ends, the Ride Thru Abort fault (fault 221) occurs. If the input power/synchronization loss ends before the ride through timer expires, the rectifier leaves Standby and re-enters its normal running state.

The ride through timer of the rectifier expires when it reaches the value in Ride Through Sec (65).

Note that the ride through timer of the rectifier is independent of the power loss timer of the inverter, and that the inverter generally enters its power loss state and starts its power loss timer as soon as the rectifier enters the Standby state and starts its ride through timer.

65 Ride Through Sec

Range:	0.00...60.00 seconds [x.xx seconds]
Default:	1.00
Access:	0 **Path:** Configuration > AC Line
See also:	64, inverter 184, 185

Defines the allowed power dip time that will not cause a Ride Thru Abort fault (fault 221).

- Setting a value of **0** generates a fault on a loss of a single line cycle.
- Setting a value of **0.10** allows line synchronization to be lost for 100 msec before a fault is generated.

A fault is also generated if the bus voltage drops below the power loss threshold before the ride-through time has elapsed.

100 Rectifier Contrl

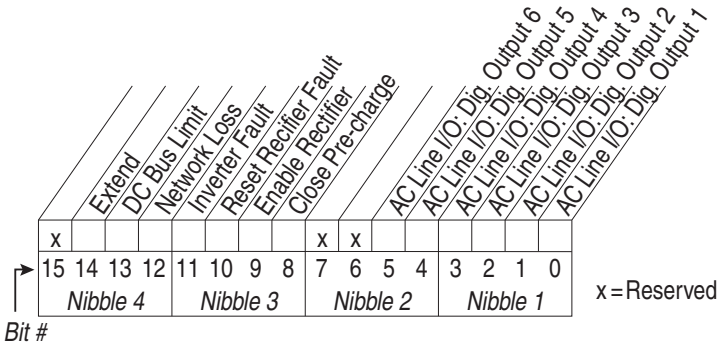
Range:	See Figure 68 and Figure 69
Default:	N/A
Access:	0 **Path:** Dynamic Control > Control and Status
See also:	inverter 33

The commanded state of the rectifier.

IMPORTANT This parameter is used for communication between the inverter and the rectifier. Do not write to this parameter using VS Utilities, DriveExplorer, or an OIM. Its value changes according to the operational state of the drive.

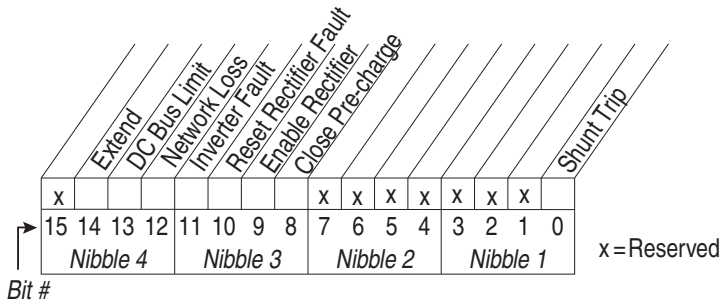
Frame 3 drives (firmware version 1.x) only:

Figure 68 - Rectifier Control (100) Frame 3


Extend
DC Bus Limit
Network Loss
Inverter Fault
Reset Rectifier Fault
Enable Rectifier
Close Pre-charge
AC Line I/O: Dig. Output 6
AC Line I/O: Dig. Output 5
AC Line I/O: Dig. Output 4
AC Line I/O: Dig. Output 3
AC Line I/O: Dig. Output 2
AC Line I/O: Dig. Output 1
x x x
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
x = Reserved

Frame 4 drives (firmware version 2.x) only:

Figure 69 - Rectifier Control (100) Frame 4



101 Rectifier Status

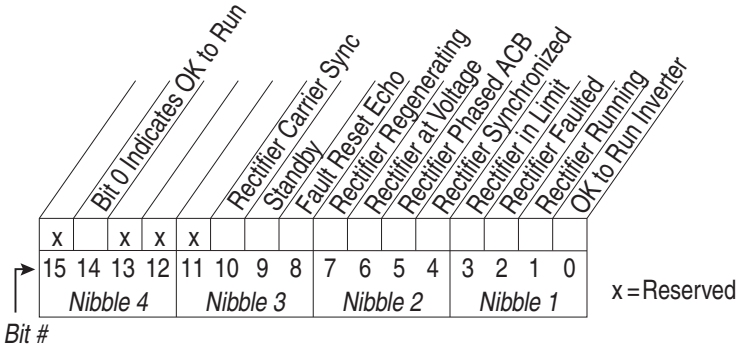
Range:	See Figure 70
Default:	N/A
Access:	0 **Path:** Dynamic Control > Control and Status
See also:	inverter 34

The actual state of the rectifier.

IMPORTANT This parameter is used for communication between the inverter and the rectifier. Do not write to this parameter using VS Utilities, DriveExplorer, or an OIM. Its value changes according to the operational state of the drive.

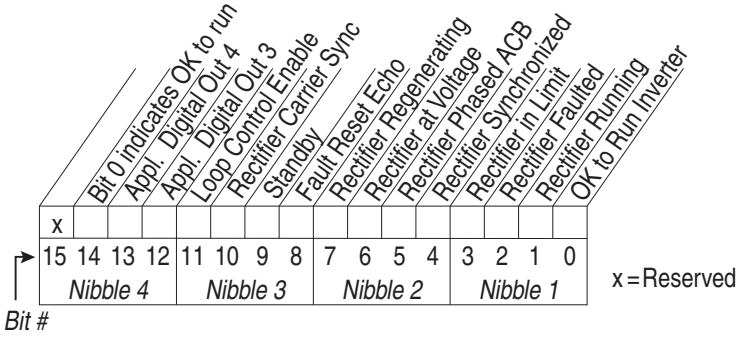
Frame 3 drives (firmware version 1.x) only:

Figure 70 - Rectifier Status (101) Frame 3



Frame 4 drives (firmware version 2.x) only:

Figure 71 - Rectifier Status (101) Frame 4



102 Vdc Optimize

Range:	0 = Disabled 1 = Enabled
Default:	0 = Disabled
Access:	0 Dynamic Control > Bus Voltage
See also:	103, 104, 107, 108, 109

Selects whether DC bus voltage (Vdc) optimization is enabled or disabled.

At low speeds the inverter requires a lower DC bus voltage, so the voltage supplied by the rectifier can be lowered to reduce switching losses. The DC bus voltage must be greater than the peak of the AC line, so this feature is more useful with 400V AC input.

If Vdc Optimize (102) is set to **Disabled**, the DC bus voltage **generated by the rectifier** while the rectifier or the entire drive is running is calculated based on a combination of the value of Vdc Reference (103) and measured line-to-line voltage of the AC line. In this case, Vdc Reference (103) defines the minimum DC bus voltage that the rectifier commands while it is running.

If Vdc Optimize (102) is set to **Enabled**, the DC bus voltage **generated by the rectifier** while the rectifier or the entire drive is running is calculated based on a combination of the DC bus level necessary to provide the motor voltage required by the inverter and the measured line-to-line voltage of the AC line. Vdc Reference (103) is not used in this case.

If Vdc Optimize (102) is set to **Enabled**, the DC bus voltage **required by the inverter** is calculated from the output frequency of the inverter and the value of the Max Motor Volts (107), Max Motor Freq (108), and Base Motor Freq (109) rectifier parameters.

103 Vdc Reference

Range:	400.0...800.0V DC [x.xV DC]
Default:	700.0
Access:	0 Dynamic Control > Bus Voltage
See also:	102, 104

If Vdc Optimize (102) is set to **Disabled**, Vdc Reference (103) is the minimum DC bus voltage generated by the rectifier while the rectifier or the entire drive is running.

If Vdc Optimize (102) is set to **Enabled**, then Vdc Reference (103) is not used.

104 Vdc Command

Range:	400.0...800.0V DC [x.xV DC]
Default:	Read Only
Access:	0 Dynamic Control > Bus Voltage
See also:	102, 103

Displays the commanded DC bus voltage.

See Vdc Optimize (102) for more information on how the rectifier derives this command when it or the entire drive is running.

When the rectifier is not running, this parameter matches the DC bus voltage as measured by the rectifier, visible in DC Bus Voltage (10).

105 Current Limit

Range:	Rectifier Rated Amps/4 to 150% of Rectifier Rated Amps [x.x A]
Default:	110% of Rectifier Rated Amps
Access:	0 **Path:** Dynamic Control > Load Limits
See also:	

The maximum RMS current the rectifier produces expressed as *x.x* A.

106 Input Load Amps

Range:	0.0 A to 1000.0 A (Frame 3) or 1600.0 A (Frame 4) [0.1 A]
Default:	Rectifier Rated Amps
Access:	0 **Path:** Dynamic Control > Load Limits
See also:	21

Sets the 100% current level for the rectifier I2T diagnostic Overload fault (fault 220).

If the input current is greater than Input Load Amps (106), then the rectifier I^2T overload percentage (as seen in Rctfr I^2T Overld, rectifier parameter 21) counts up.

If Rctfr I^2T Overld (21) reaches 100%, the Rectfier I^2T Overload fault (fault 220) occurs.

107 Max Motor Volts

Range:	60.0...480.0V AC [0.1V AC]
Default:	480.0
Access:	0 **Path:** Dynamic Control > Load Limits
See also:	102, 104, 108, 109, inverter 54

If Vdc Optimize (102) is set to **Enabled**, the DC bus voltage **generated by the rectifier** while the rectifier or the entire drive is running is calculated based on a combination of the DC bus level necessary to provide the motor voltage required by the inverter and the measured line-to-line voltage of the AC line.

Max Motor Volts (107) is the maximum RMS motor voltage requirement that can be calculated by the Vdc Optimize function.

The Vdc Optimize function calculates the motor voltage requirement as Max Motor Volts (107) when the output (motor) frequency is equal to Base Motor Freq (109), and from that point linearly varies the calculated motor voltage requirement down to 0 Volts at 0 Hz output frequency. If the output frequency is greater than Base Motor Frequency (109), the calculated motor voltage requirement is limited to Max Motor Volts (107).

If Vdc Optimize (102) is set to **Enabled**, Max Motor Volts (107) should have the same value as inverter parameter Maximum Voltage (54).

If Vdc Optimize (102) is set to **Disabled**, Max Motor Volts (107) is not used.

108 Max Motor Freq

Range:	5.0...400.0 [0.1 Hz]
Default:	130.0
Access:	0 **Path:** Dynamic Control > Load Limits
See also:	102, 104, 107, 109, inverter 55

The maximum frequency that can be commanded by the inverter.

This value is used for calculating drive output frequency as part of the determination of the optimal DC bus voltage to command.

Max Motor Freq (108) should have the same value as inverter parameter Maximum Freq (55). This parameter is only used if Vdc Optimize (102) is set to **Enabled**.

109 Base Motor Freq

Range: 5.0...400.0 [0.1 Hz]
Default: 60.0
Access: 0 **Path:** Dynamic Control > Load Limits
See also: 102, 104, 107, 108, inverter 43

The base frequency for the motor, for the purpose of calculating the optimal DC bus voltage.

This parameter is only used when Vdc Optimize (102) is set to **Enabled**.

See the description of Max Motor Volts (107) for a full description of how this parameter is used.

Base Motor Freq (109) normally has the same value as inverter parameter Motor NP Hertz (43).

110 VML Ki

Range: 0...65535
Default: Based on drive size
Access: 0 **Path:** Dynamic Control > Regulator Tuning
See also:

Voltage Major Loop integral gain.

111 VML Kp

Range: 0...65535
Default: Based on drive size
Access: 0 **Path:** Dynamic Control > Regulator Tuning
See also:

Voltage Major Loop proportional gain.

112 CML Ki

Range: 0...65535
Default: Based on drive size
Access: 0 **Path:** Dynamic Control > Regulator Tuning
See also:

Current Minor Loop integral gain.

113 CML Kp

Range: 0...65535
Default: Based on drive size
Access: 0 **Path:** Dynamic Control > Regulator Tuning
See also:

Current Minor Loop integral gain.

114 VML Reset Level

Range: 10.0...300.0V DC [0.1V DC]
Default: Based on drive size
Access: 0 **Path:** Dynamic Control > Regulator Tuning
See also:

The threshold for resetting the voltage loop integrator.

120 Cold Plate Temp

Range: -20.0...120.0 °C [0.1 °C]
Default: Read Only
Access: 0 **Path:** Dynamic Control > Cold Plate
See also: 121, 122, 129

The measured cold plate temperature is displayed as *x.x* degrees C.

In drives that do not have a cold plate temperature sensor, this number is not usable.

121 Invtr Base Temp

Range: -20.0...120.0°C [0.1°C]
Default: Read Only
Access: 0 **Path:** Dynamic Control > Cold Plate
See also: 120, 122, 129

The hottest measured inverter IGBT module temperature is displayed as *x.x* degrees C. This value is received from the inverter via DPI datalink.

122 Rctfr Base Temp

Range: -20.0...120.0 °C [0.1 °C]
Default: Read Only
Access: 0 **Path:** Dynamic Control > Cold Plate
See also: 120, 121, 129

The hottest measured rectifier IGBT module temperature is displayed as *x.x* degrees C.

123 CPC K1
124 CPC K2
125 High Temp Limit
126 Low Temp Limit
127 Start Move Time
128 Delay After Move

Range:	0...65535		
Default:	0		
Access:	0	**Path:**	Dynamic Control > Cold Plate
See also:			

These parameters are reserved for future use.

129 Ambient Temp

Range:	-20.0...120.0 °C [0.1 °C]		
Default:	Read Only		
Access:	0	**Path:**	Dynamic Control > Cold Plate
See also:	120, 121, 122		

Displays the measured ambient temperature inside the power module.

150 Input Load Amps

Range:	0.0...100.0		
Default:	Read Only		
Access:	0	**Path:**	Internal Data > Normalized Amps
See also:			

Displays measured average amps normalized to 100.0 for 100% of rectifier rating.

151 Current Limit

Range:	0...32767		
Default:	Read Only		
Access:	0	Path:	Internal Data > Normalized Amps
See also:			

Displays the value of the current limit normalized to 4096 for rated current.

152 Life KWH

Range:	0.0...429496729.5 kWh		
Default:	Read Only		
Access:	0	**Path:**	Internal Data > Total Elapsed
See also:			

Displays the kWH accumulated over the life of the product.

153 Life Run Time

Range:	0.0000 to 429496.7295 hours
Default:	Read Only
Access:	0 **Path:** Internal Data > Total Elapsed
See also:	

Displays the run time accumulated over the life of the product.

154 Life Power Time

Range:	0.0000...429496.7295 hours
Default:	Read Only
Access:	0 **Path:** Internal Data > Total Elapsed
See also:	

Displays the time that power was applied to the drive.

155 Life Power Cycle

Range:	0...4294967295
Default:	Read Only
Access:	0 **Path:** Internal Data > Total Elapsed
See also:	

Displays the accumulated number of times power was cycled over the life of the product.

156 DPI Error

Range:	0...255
Default:	Read Only
Access:	0 **Path:** Internal Data > DPI Counters
See also:	

Increments when there is a DPI error.

157 CS Msg Rx Cnt

Range:	0...65535
Default:	Read Only
Access:	0 **Path:** Internal Data > DPI Counters
See also:	

Increments when a DPI client/server message is received.

158 CS Msg Tx Cnt

Range: 0...65535
Default: Read Only
Access: 0 **Path:** Internal Data > DPI Counters
See also:

Increments when a DPI client/server message is transmitted.

159 CS Timeout Cnt

Range: 0...255
Default: Read Only
Access: 0 **Path:** Internal Data > DPI Counters
See also:

Increments when a DPI client/server message times out.

160 CS MSG Bad Cnt

Range: 0...255
Default: Read Only
Access: 0 **Path:** Internal Data > DPI Counters
See also:

Increments when a bad DPI client/server request is received.

161 PC MSG Rx Cnt

Range: 0...65535
Default: Read Only
Access: 0 **Path:** Internal Data > DPI Counters
See also:

Increments when a DPI producer/consumer message is received.

162 PC MSG Tx Cnt

Range: 0...65535
Default: Read Only
Access: 0 **Path:** Internal Data > DPI Counters
See also:

Increments when a DPI producer/consumer message is transmitted.

163 PC Timeout Cnt

Range:	0...255	
Default:	Read Only	
Access:	0	**Path:** Internal Data > DPI Counters
See also:		

Increments when a DPI producer/consumer message times out.

164 CAN Bus Off Cnt

Range:	0...65535	
Default:	Read Only	
Access:	0	**Path:** Internal Data > DPI Counters
See also:		

Increments when DPI CAN bus is off.

171 D/A Select (N)
172
173
174

Range:	0...65535	
Default:	Read Only	
Access:	0	**Path:** Internal Data > D/A Output Sel
See also:		

Selects signals to map to a D/A test card.

196 Param Access Lvl

Range:	0 = Basic 1 = Advanced	
Default:	0	
Access:	0	Path: Utility > Drive Memory
See also:		

Contains the present rectifier parameter access level. See Chapter 8 for more information about parameter access levels.

197 Reset to Defalts

Range: 0 = Ready
1 = Factory
2 = Low Voltage
3 = High Voltage

Default: 0

Access: 0 **Path:** Utility > Drive Memory

See also:

Writing a 1 to this parameter resets the rectifier to factory default values.

After a Reset to Defaults operation is performed, the value of this parameter reverts back to 0 for Ready.

198 Load Frm Usr Set

Range: 0...3

Default: Read Only

Access: 0 Path: Utility > Drive Memory

See also:

This parameter is not used in the Liquiflo 2.0 rectifier.

199 Save to User Set

Range: 0...3

Default: Read Only

Access: 0 **Path:** Utility > Drive Memory

See also:

This parameter is not used in the Liquiflo 2.0 rectifier.

200 Reset Meters

Range: 0 = Ready
1 = MWh
2 = Elapsed Time

Default: 0

Access: 0 **Path:** Utility > Drive Memory

See also:

Writing a 1 to this parameter resets the rectifier elapsed data parameters.

After a Reset Meters operation is completed, the value of this parameter reverts back to 0 for **Ready**.

201 Language

Range: 0...10
Default: Read Only
Access: 0 **Path:** Utility > Drive Memory
See also:

This parameter is not used in the Liquiflo 2.0 rectifier.

203 Drive Checksum

Range: 0...65535
Default: Read Only
Access: 0 Path: Utility > Drive Memory
See also:

This parameter is not used in the Liquiflo 2.0 rectifier.

211 Drive Alarm

Range:
Default: Read Only
Access: 0 **Path:** Utility > Status
See also:

Reserved for future alarms.

214 Start Inhibits

Range:
Default: Read Only
Access: 0 Path: Utility > Status
See also:

Reserved for inhibit bits.

216 Dig In Status

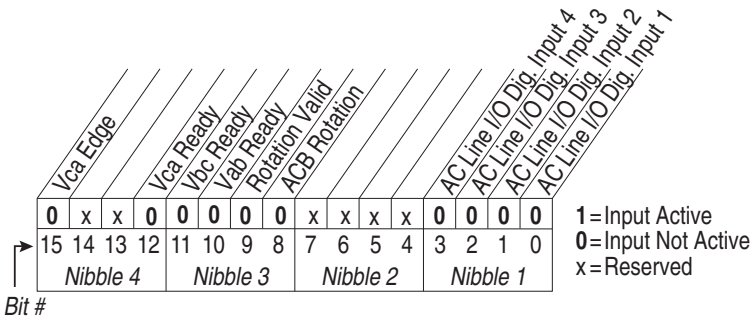
Range: Bits on/off
Default: Read Only
Access: 0 **Path:** Utility > Status
See also:

Displays status of the rectifier digital inputs.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the rectifier.

Frame 3 drives (firmware version 1.x) only:

Figure 72 - Dig In Status (216) Frame 3


Vca Edge
Vca Ready
Vbc Ready
Vab Ready
Rotation Valid
ACB Rotation
AC Line I/O Dig. Input 4
AC Line I/O Dig. Input 3
AC Line I/O Dig. Input 2
AC Line I/O Dig. Input 1
0 x x 0 0 0 0 0 x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Active
0 = Input Not Active
x = Reserved

On the Frame 3 drive, AC Line I/O Digital Input 1 is used for precharge contactor feedback.

- A **1** in bit 0 indicates that all of the precharge contactors are closed.
- A **0** in bit 0 indicates that at least one of the contactors is open.

Also on the Frame 3 drive, bit 9 indicates that AC line rotation has been determined, bit 8 indicates whether the rotation is ACB (not usable) or ABC (usable), and bits 10...15 provide information about the internal state of the AC line synchronization function of the AC Line I/O board. Bits 10...15 are for engineering use only.

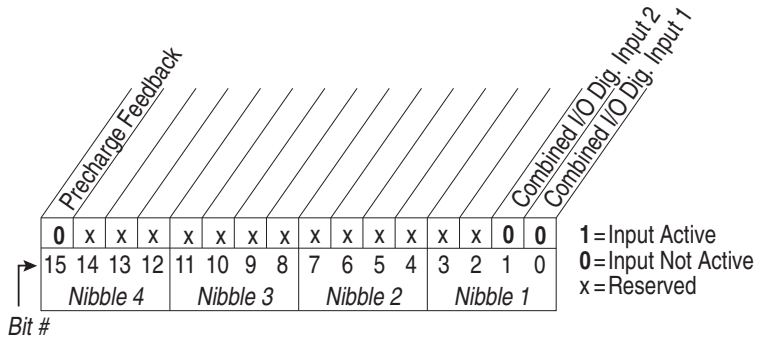
On the Frame 3 drive, AC Line I/O Digital Inputs 3 and 4 are used to select measurements to be displayed on the optional input voltage and current meters, as described in Table 13.

Table 13 - AC Line I/O Digital Inputs 3 and 4 (Frame 3)

Dig. In 4	Dig. In 3	Selected Measurement
0	0	Iv, Vst
0	1	Iw, Vtr
1	0	Iu, Vrs
1	1	Iu, Vrs

Frame 4 drives (firmware version 2.x) only:

Figure 73 - Dig In Status (216) Frame 4


Precharge Feedback
Combined I/O Dig. Input 2
Combined I/O Dig. Input 1
0 x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Active
0 = Input Not Active
x = Reserved

On the Frame 4 drive, precharge contactor feedback appears in bit 15 of this parameter.

- A **1** in bit 15 indicates that all of the precharge contactors are closed.
- A **0** in bit 15 indicates that at least one of the contactors is open.

On the Frame 4 drive, Combined I/O board Digital Inputs 1 and 2 are used to select measurements to be displayed on the optional input voltage and current meters, as described in Table 14.

Table 14 - AC Line I/O Digital Inputs 3 and 4 (Frame 4)

Dig. In 2	Dig. In 1	Selected Measurement
0	0	Iv, Vst
0	1	Iw, Vtr
1	0	Iu, Vrs
1	1	Iu, Vrs

217 Dig Out Status

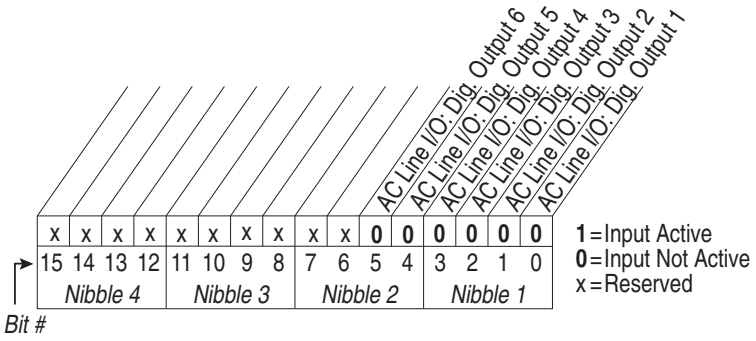
Range:	Bits on/off
Default:	Read Only
Access:	0 Path: Utility > Status
See also:	inverter 30

Displays commanded status of the digital outputs that are controlled by the rectifier.

See AC Line I/O Board Description (Frame 3 Only) on page 25 through Combined I/O Board Description (Frame 4 Only) on page 29 for a description of I/O hardware that is present on this drive and is controlled by the rectifier.

Frame 3 drives (firmware version 1.x) only:

Figure 74 - Dig Out Status (217) Frame 3


AC Line I/O: Dig. Output 6
AC Line I/O: Dig. Output 5
AC Line I/O: Dig. Output 4
AC Line I/O: Dig. Output 3
AC Line I/O: Dig. Output 2
AC Line I/O: Dig. Output 1
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Active
0 = Input Not Active
x = Reserved

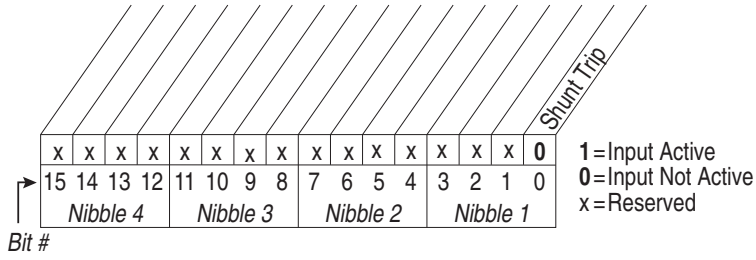
On the Frame 3 drive, AC Line I/O Board Digital Output 1 is used to control the shunt trip, and various conditions inside the drive can cause the shunt trip to be commanded.

- A **1** in bit 0 indicates that the shunt trip is being commanded (breaker commanded open).
- A **0** in bit 0 indicates that the shunt trip is not being commanded.

AC Line I/O Board Digital Outputs 1...6 are also called the **application digital outputs**. They are commanded by the inverter using bits 0...5 of rectifier parameter Rectifier Contrl (100), but you should not write to this parameter. You can control these outputs using inverter parameter Appl Digital Out (30). For AC Line I/O Board Digital Output 1, this shunt trip control via rectifier parameter Rectifier Contrl (100) is in addition to the internal rectifier conditions that can cause a shunt trip.

Frame 4 drives (firmware version 2.x) only:

Figure 75 - Dig Out Status (217) Frame 4


Shunt Trip
x x x x x x x x x x x x x x x 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Active
0 = Input Not Active
x = Reserved

On the Frame 4 drive, the Combined I/O Board dedicated Shunt Trip output is used to control the shunt trip, and various conditions inside the drive can cause the shunt trip to be commanded.

- A **1** in bit 0 of this parameter indicates that the shunt trip is being commanded (breaker commanded open).
- A **0** in bit 0 indicates that the shunt trip is not being commanded.

The Combined I/O Board Shunt Trip output can also be commanded using bit 0 of rectifier parameter Rectifier Control (100), but you should not write to this parameter. You can control the shunt trip output using bit 0 of inverter parameter Appl Digital Out (30). For the dedicated shunt trip digital output, shunt trip control via rectifier parameter Rectifier Contrl (100) is in addition to the internal rectifier conditions that can cause a shunt trip.

220 Fault Frequency

Range:	-/+ 400.0 Hz [0.1 Hz]		
Default:	Read Only		
Access:	0	**Path:** Utility > Diagnostics	
See also:			

Displays line frequency at the time of the most recent fault.

221 Fault Amps R

Range:	0.0...3276.7 A [0.1 A]		
Default:	Read Only		
Access:	0	**Path:** Utility > Diagnostics	
See also:			

Displays phase R RMS input current at the time of the most recent fault.

222 Fault Amps S

Range:	0.0...3276.7 A [0.1 A]		
Default:	Read Only		
Access:	0	Path: Utility > Diagnostics	
See also:			

Displays phase S RMS input current at the time of the most recent fault.

223 Fault Amps T

Range:	0.0...3276.7 A [0.1 A]		
Default:	Read Only		
Access:	0	Path: Utility > Diagnostics	
See also:			

Displays phase T RMS input current at the time of the most recent fault.

224 Fault Amps Q

Range:	0.0...3276.7 A [0.1 A]		
Default:	Read Only		
Access:	0	Path: Utility > Diagnostics	
See also:			

Displays active input current at the time of the most recent fault.

225 Fault Amps D

Range: 0.0...3276.7 A [0.1 A]
Default: Read Only
Access: 0 **Path:** Utility > Diagnostics
See also:

Displays reactive input current at the time of the most recent fault.

226 Fault Volts Vdc

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Utility > Diagnostics
See also:

Displays DC bus voltage at the time of the most recent fault.

227 Fault Volts Q

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Utility > Diagnostics
See also:

Displays commanded active line voltage at the time of the most recent fault.

228 Fault Volts D

Range: 0.0...3276.7V DC [0.1V DC]
Default: Read Only
Access: 0 **Path:** Utility > Diagnostics
See also:

Displays commanded reactive line voltage at the time of the most recent fault.

234 Testpoint 1 Sel

Range: 0...65535
Default: 499
Access: 0 **Path:** Utility > Diagnostics
See also:

This parameter is for service use only.

235 Testpoint 1 Data

Range: -/+ 217483646
Default: 0
Access: 0 **Path:** Utility > Diagnostics
See also:

This parameter is for service use only.

236 Testpoint 2 Sel

Range: 0...65535
Default: 499
Access: 0 **Path:** Utility > Diagnostics
See also:

This parameter is for service use only.

237 Testpoint 2 Data

Range: -/+ 217483646
Default: 0
Access: 0 **Path:** Utility > Diagnostics
See also:

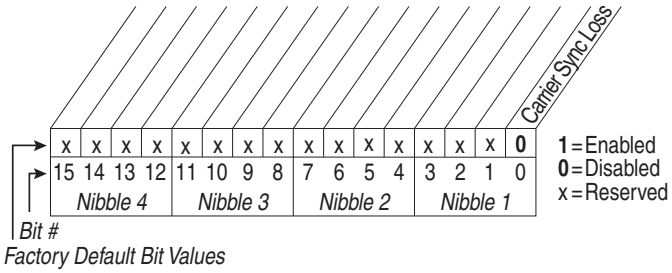
This parameter is for service use only.

238 Fault Config

Range: See Figure 76
Default: See Figure 76
Access: 0 **Path:** Utility > Fault Queue
See also:

Enables/disables annunciation of the faults shown in Figure 76.

Figure 76 - Fault Config (238)


Carrier Sync Loss
x x x x x x x x x x x x x x x 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

240 Fault Clear

Range:	0 = Ready 1 = Clear Faults 2 = Clear Flt Queue
Default:	Read Only
Access:	0 **Path:** Utility > Fault Queue
See also:	

Faults in the rectifier may be cleared, and the fault queue cleared by writing to this parameter. After the operation is completed, the value of this parameter will revert to **Ready** (0).

241 Fault To Invertr

Range:	0...255
Default:	Read Only
Access:	0 **Path:** Utility > Fault Queue
See also:	

This value is copied to the inverter through a datalink to transmit rectifier faults to the inverter. This parameter is part of inverter/rectifier communications. Do not write to this parameter.

242 Power Up Marker

Range:	0.0000...429496.7295 [Hours]
Default:	Read Only
Access:	0 **Path:** Utility > Fault Queue
See also:	

Accumulated hours that the rectifier had been powered up at the time of the most recent drive powerup.

This parameter is used along with the rectifier fault timestamp parameters (Fault *n* Time parameters below[244, 246, 248, 250]) to determine whether a rectifier fault in the rectifier fault queue happened before or after the most recent drive powerup.

This value rolls over to 0 after the drive has been powered on for more than the maximum value shown.

243 Fault 1 Code
245 Fault 2 Code
247 Fault 3 Code
249 Fault 4 Code

Range:	0...65535		
Default:	Read Only		
Access:	0	**Path:**	Utility > Fault Queue
See also:			

A code that represents a rectifier fault. The codes appear in these parameters in the order they occur. Fault 1 Code = the most recent fault.

244 Fault 1 Time
246 Fault 2 Time
248 Fault 3 Time
250 Fault 4 Time

Range:	0.0000...429496.7295 [Hours]		
Default:	Read Only		
Access:	0	**Path:**	Utility > Fault Queue
See also:			

The time between initial power up and the occurrence of the associated fault. Can be compared to Power Up Marker for the time from the most recent power up.

(Fault x Time – Power Up Marker) = the time difference to the most recent power up. A negative value indicates a fault occurred before the most recent power up. A positive value indicates a fault occurred after the most recent power up.

300 IOC Redir Time

Range:	0...43200 minutes [30 days]		
Default:	1440 minutes [24 hours]		
Access:	0	**Path:**	Communications > In Data Links
See also:	301		

Amount of time used to determine whether rectifier Instantaneous Overcurrent (IOC) fault redirection is discontinued because too many rectifier IOC events have occurred in too short a period of time.

Certain AC line events cause the drive to stop running because of the detection of a rectifier IOC condition. IOC fault redirection is a mechanism that allows rectifier IOC conditions to be reported as Input Current Imbalance faults (fault 225) rather than as rectifier IOC faults (rectifier faults 12, 211, 212, 213). The purpose of this mechanism is to allow external drive control equipment to distinguish between faults caused by AC line events and faults caused by internal drive conditions.

A rectifier IOC condition is considered to be **redirectable** if it occurs more than 1 minute after the rectifier starts running. Any rectifier IOC condition occurring within 1 minute of a rectifier start is always reported as a rectifier IOC fault; it is assumed that these faults are caused by conditions within the drive and not by events on the AC line.

The number of redirects allowed and the amount of time allowed for them before the redirection is discontinued are controlled by rectifier parameters 300 and 301. The default parameters are five redirects allowed in 24 hours.

Once redirection has been discontinued, it remains discontinued until the drive is power cycled or until a time equal to the value of IOC Redir Time (300) has gone by since the last redirectable event.

- Redirection can be turned **off** (disabled) by setting IOC Redir Max (301) to 0.
- Redirection can be turned **on** (enabled) by setting IOC Redir Time (300) to 0 and IOC Redir Max (301) to a nonzero value.

301 IOC Redir Max

Range:	0...30	
Default:	5	
Access:	0	**Path:** Communications > In Data Links
See also:	300	

Number of rectifier Instantaneous Overcurrent (IOC) events that can occur before IOC fault redirection is disabled.

See rectifier parameter 300 for a description of the rectifier IOC fault redirect facility.

302 Service 302

Range:	0...32767	
Default:	1000	
Access:	0	**Path:** Communications > In Data Links
See also:		

This parameter is for use by service personnel only.

303 Service 303

Range:	0...32767	
Default:	N/A	
Access:	0	**Path:** Communications > In Data Links
See also:		

This parameter is for use by service personnel only.

345 Rct IGBT Tmp Top

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also: 346, 347, 348

Displays the measured temperature of the top rectifier IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.x series.

346 Rct IGBT Tmp Up

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also: 345, 347, 348

Displays the measured temperature of the upper rectifier IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

347 Rct IGBT Tmp Low

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also: 345, 346, 348

Displays the measured temperature of the lower rectifier IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

348 Rct IGBT Tmp Bot

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also: 345, 346, 347

Displays the measured temperature of the bottom rectifier IGBT power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

349 Rct ColdpIt Tmp

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured rectifier coldplate temperature in degrees C. This parameter is only usable if a coldplate temperature sensor is installed in the drive.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

350 Rct Ambient Tmp

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured ambient temperature inside the power module in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

351 Rct PS Tmp

Range: -3276.8...3276.7 °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured drive power supply temperature in degrees C.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

352 Rct PS +12V

Range: -3276.8...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage of the +12V power supply.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

353 Rct PS -12V

Range: -3276.8...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage of the –12V power supply.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

354 Rct I/O ID V

Range: -3276.8...3276.7V °C

Default: Read Only

Access: 1 **Path:** Inputs & Outputs > Temperature etc

See also:

Displays the measured voltage that identifies which type of IO board is installed.

This parameter is only present on Frame 4 drives. All such drives should have firmware version numbers in the 2.*x* series.

Troubleshooting the Drive

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

The LiquiFlo 2.0 AC drive provides the following ways to determine the status of the drive and to troubleshoot problems that may occur:

- LEDs on the front of the drive
- User-configurable and non-configurable alarms
- User-configurable and non-configurable faults
- Entries in the fault queue
- Drive status parameters

Verify that the DC Bus Capacitors are Discharged Before Servicing the Drive

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait 5 minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

The DC bus capacitors of the drive retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components.

1. Turn off the circuit breaker and lock out input power. Wait 5 minutes.
2. Open the enclosure door to the power module.
3. Verify that there is no voltage at the power module's input power terminals (L1, L2, and L3) as shown in Figure 2 on page 15 for Frame 3, and Figure 5 on page 20 for Frame 4.
4. Remove the cover of the power module.

5. Measure the DC bus potential with a voltmeter while standing on a non-conductive surface and wearing insulated gloves. See Figure 77 for Frame 3, and Figure 78 for Frame 4.
6. Once the drive has been serviced, reattach the power module cover and close the enclosure door.
7. Turn on the circuit breaker.

Figure 77 - Location of DC Bus Measuring Points (Frame 3)

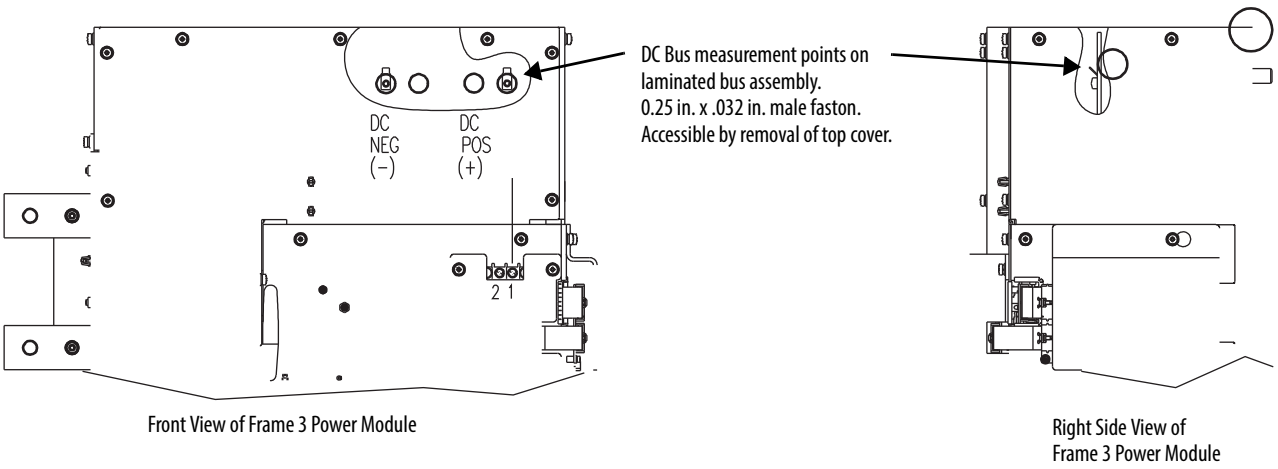
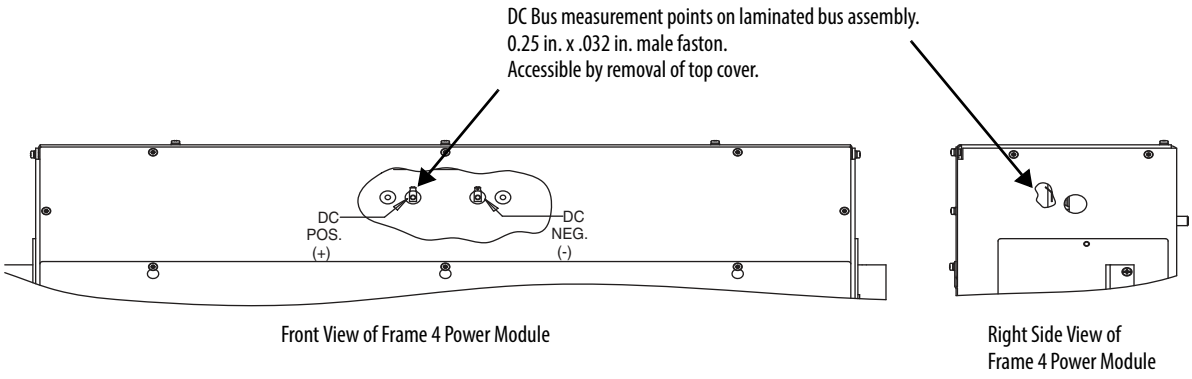

DC Bus measurement points on laminated bus assembly.
0.25 in. x .032 in. male faston.
Accessible by removal of top cover.
DC NEG (–)
DC POS (+)
2 1
Front View of Frame 3 Power Module
Right Side View of Frame 3 Power Module

Figure 78 - Location of DC Bus Measuring Points (Frame 4)


DC Bus measurement points on laminated bus assembly.
0.25 in. x .032 in. male faston.
Accessible by removal of top cover.
DC POS. (+)
DC NEG. (-)
Front View of Frame 4 Power Module
Right Side View of Frame 4 Power Module

Determining Drive Status Using the Status LEDs

The inverter and rectifier sections each have a status LED.

For Frame 3 drives, the status LEDs are located on the Communication Interface board, and are labeled on the board itself as **INV STATUS** (inverter) and **ACTIVE RECT. STATUS** (rectifier). See Figure 79.

For Frame 4 drives, the status LEDs are located on the Control Board, and are labeled on the board itself as **B2** (inverter) and **B1** (rectifier). See Figure 80.

Figure 79 - Location of the Status LEDs (Frame 3)

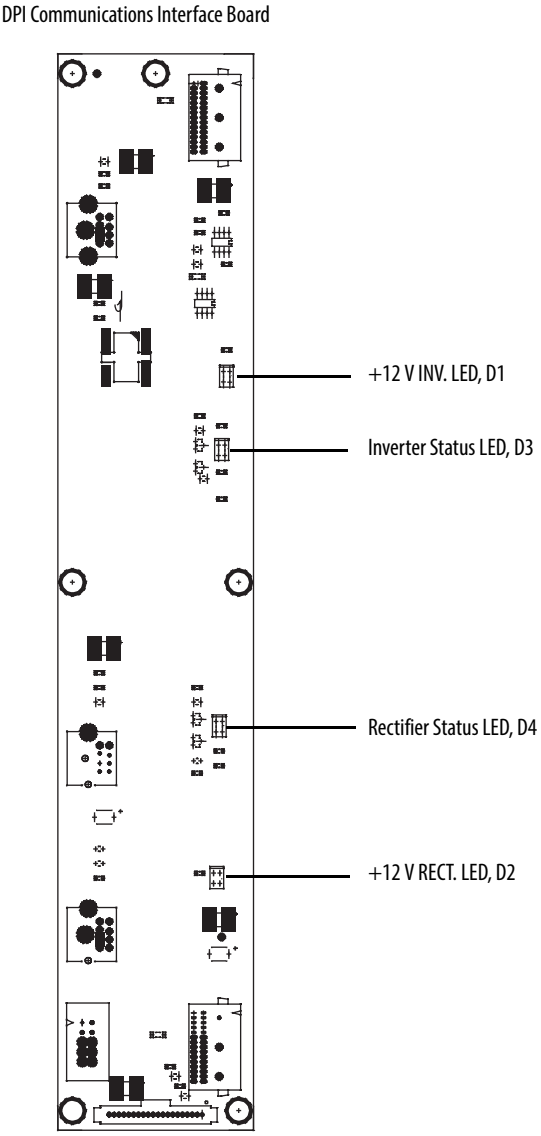


Figure 80 - Location of the Status LEDs (Frame 4)

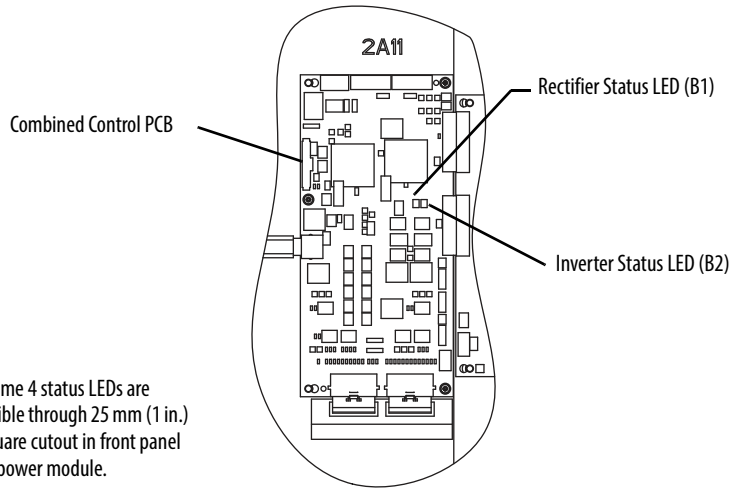

2A11
Combined Control PCB
Rectifier Status LED (B1)
Inverter Status LED (B2)
Frame 4 status LEDs are visible through 25 mm (1 in.) square cutout in front panel of power module.

Table 15 - Inverter Status LED Definitions

Color	State	Description
Green	Flashing	Drive ready, but not running and no faults or alarms are present.
	Steady	Drive running, no faults or alarms are present.
Yellow See About Alarms on page 198.	Flashing	The drive is not ready. Check inverter parameter 214 (Start Inhibits).
	Steady	An alarm condition exists; drive may be running. Check inverter parameters 211 (Drive Alarm 1) and 212 (Drive Alarm 2).
Red See About Faults on page 201.	Flashing	A fault has occurred.
	Steady	A non-resettable fault has occurred.

Table 16 - Rectifier Status LED Definitions

Color	State	Description
Green	Flashing	Rectifier ready, but not running and no faults are present.
	Steady	Rectifier running (providing current to inverter).
Yellow	Flashing	Precharge contactor is open and rectifier is not running. This is the normal state if the inverter is not running.
	Steady	A rectifier alarm condition exists; rectifier may be running. Check rectifier parameter 211 (Alarm Status).
Red	Flashing	A rectifier fault has occurred. This also causes an inverter fault, and the fault is enunciated on the OIM or other DPI device.
	Steady	A non-resettable rectifier fault has occurred.

IMPORTANT Certain hardware failures produce indications on the status LEDs that are not covered in the above tables. For Frame 3 drives, the appropriate response to the appearance of any of these indications is to replace either the Rectifier Control board or Inverter Control board depending on which LED displays the indication. For Frame 4 drives, the appropriate response is always to replace the Control board. Table 17 lists the indications.

Table 17 - Status LED Definitions for Hardware Failure

LED Indication	Condition
Red/green alternating	Control board boot firmware is running because control board application firmware is corrupted.
Yellow/green/red repeating pattern	Control board RAM has failed or control board boot firmware is corrupted.

About Alarms

Alarms indicate conditions that may affect drive operation or application performance.

There are two alarm types, as described in Table 18.

Table 18 - Types of Alarms

Type	Alarm Description	
①	User-configurable	These alarms alert the operator of conditions that, if left untreated, may lead to a fault condition. The drive continues to operate during the alarm condition. The alarms are enabled or disabled using inverter Alarm Config 1 (259). The status of these alarms is shown in inverter Drive Alarm 1 (211).
②	Non-configurable	These alarms alert the operator of conditions caused by improper programming and prevent the drive from starting until the problem is resolved. These alarms are always enabled. The status of these alarms is shown in inverter Drive Alarm 2 (212).

The drive indicates alarm conditions in the following ways:

- **Status LEDs** (see Determining Drive Status Using the Status LEDs on page 196).
- **Alarm name and bell graphic** on the OIM (see Appendix B). The alarm is displayed as long as the condition exists. The drive automatically clears the alarm when the condition causing it is removed. The OIM only displays alarm names for type 2 alarms, not for type 1 alarms. The bell graphic appears for both type 1 and type 2 alarms.
- **Alarm status parameters**. Two 16-bit inverter parameters, Drive Alarm 1 (211) and Drive Alarm 2 (212), indicate the status of type 1 and type 2 alarms, respectively. See Chapter 9 for the parameter descriptions.
- **Alarm queue**. Alarms are placed into an alarm queue on the inverter as they occur. The alarms in the queue do not have timestamps, and there is no indication of when each alarm becomes inactive. The queue is visible using the OIM and using VS Utilities. The alarm queue is separate from the inverter fault queue.

Alarm Descriptions

<table>
<tr><th>Alarm</th><th>Type</th><th>Description</th></tr>
<tr><td>Analog In Loss</td><td>①</td><td>A user-configurable analog input is configured for alarm on signal loss and signal loss has occurred.</td></tr>
<tr><td>Bipolar Conflict</td><td>②</td><td>Parameter inverter 190 (Direction Mode) is set to Bipolar or Reverse Dis and one of more of the following digital input functions is configured: Fwd/Rev, Run Fwd, Run Rev, Jog Fwd, or Jog Rev.</td></tr>
<tr><td>Dig In ConflictA</td><td>②</td><td>User-configurable digital input functions are in conflict. Combinations marked with a 🔔 will cause an alarm.
<table>
<tr><th></th><th>Acc2 / Dec2</th><th>Accel 2</th><th>Decel 2</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd / Rev</th></tr>
<tr><td>Acc2 / Dec2</td><td></td><td>🔔</td><td>🔔</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Accel 2</td><td>🔔</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decel 2</td><td>🔔</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td></td><td>🔔</td><td>🔔</td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td>🔔</td><td></td><td></td><td>🔔</td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td>🔔</td><td></td><td></td><td>🔔</td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td></td><td>🔔</td><td>🔔</td><td></td></tr>
</table>
</td></tr>
</table>

Alarm	Type	Description
Dig In ConflictB	②	User-configurable digital input functions are in conflict. Combinations marked with a 🔔 will cause an alarm.

	Start	Stop–CF	Run	Run Fwd	Run Rev	Jog	Jog Fwd	Jog Rev	Fwd/ Rev
Start			🔔	🔔	🔔		🔔	🔔	
Stop–CF									
Run	🔔			🔔	🔔		🔔	🔔	
Run Fwd	🔔		🔔			🔔			🔔
Run Rev	🔔		🔔			🔔			🔔
Jog				🔔	🔔				
Jog Fwd	🔔		🔔						
Jog Rev	🔔		🔔						
Fwd / Rev				🔔	🔔				

Dig In ConflictC	②	More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions: Forward/Reverse, Speed Select 1, Speed Select 2, Speed Select 3, Run Forward, Run Reverse, Jog Forward, Jog Reverse, Stop Mode B, Bus Regulation Mode B, Acc2 / Dec2, Accel 2, Decel 2, Run
Drive OL Level 1	①	The calculated inverter IGBT temperature requires a reduction in PWM carrier frequency. If inverter Drive OL Mode (150) is disabled and the load is not reduced, an overload fault eventually occurs.
Drive OL Level 2	①	The calculated inverter IGBT temperature requires a reduction in Current Limit. If inverter Drive OL Mode (150) is disabled and the load is not reduced, an overload fault eventually occurs.
Flux Amps Ref Rang	②	Result of autotune procedure (inverter 61).
IntDBRes OvrHeat	①	The drive has temporarily disabled the dynamic braking regulator because the resistor temperature has exceeded a predetermined value.
IR Volts Range	②	The drive autotuning default is Calculate and the value calculated for IR Drop Volts is not in the range of acceptable values. This alarm should clear when all motor nameplate data is properly entered.
MaxFreq Conflict	②	The sum of inverter Maximum Speed (82) and inverter Overspeed Limit (83) exceeds inverter Maximum Freq (55). Raise inverter Maximum Freq (55) or lower inverter Maximum Speed (82) and/or inverter Overspeed Limit (83) so that the sum is less than or equal to inverter Maximum Freq (55).
Motor Type Cflct	②	Inverter Motor Type (90) has been set to Sync Prm Mag or Sync Reluc, and one or more DC functions (for example, DC Boost, DC Brake, etc.) have been activated. DC injection functions are incompatible with synchronous motors and may demagnetize them.
No Line Sync	①	Rectifier cannot synchronize to the AC line.
NP Hz Conflict	②	Fan/pump mode is selected in inverter Torq Perf Mode (53), and the ratio of inverter Motor NP Hertz (43) to inverter Maximum Freq (55) is greater than 26.
Power Loss	①	Drive has sensed a power line loss.
Power Phased ACB	①	Input power phases are connected ACB, two input phases must be switched.
Prechrg Actv	①	Drive is in the initial DC bus precharge state.
Speed Ref Cflct	②	Inverter Speed Ref x Sel or inverter PI Reference Sel is set to **Reserved**.
Under-Voltage	①	The bus voltage has dropped below a predetermined value.
VHz Neg Slope	②	Custom V/Hz mode has been selected in inverter Torq Perf Mode (53) and the V/Hz slope is negative.

Table 19 - Alarm Names Cross-Referenced by Alarm Numbers

No. (1)	Alarm	No. (1)	Alarm
1	Precharge Active	18	Dig In ConflictB
2	UnderVoltage	19	Dig In ConflictC
3	Power Loss	20	Bipolar Conflict
5	Analog In Loss	21	Motor Type Conflict
6	IntDBRes OvrHeat	22	NP Hz Conflict
8	Drive OL Level 1	23	MaxFreq Conflict
9	Drive OL Level 2	24	VHz Neg Slope
12	No Line Sync	25	IR Volts Range
13	Power Phased ACB	26	FluxAmps Ref Rang
17	Dig In ConflictA	27	Speed Ref Cflct

(1) Alarm numbers not listed are reserved for future use.

About Faults

Faults indicate conditions within the drive that require immediate attention. The drive responds to a fault by initiating a coast-to-stop sequence and turning off output power to the motor.

In addition, some faults are auto-resettable, non-resettable, and/or user-configurable as described in Table 20.

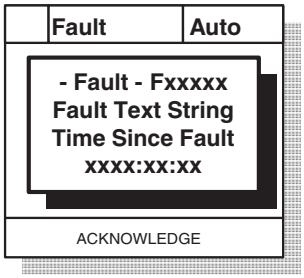
Table 20 - Fault Types

Type	Fault Description	
①	Auto-Reset/Run	If the drive is running when this type of fault occurs, and Auto Rstrt Tries (174) is set to a value greater than 0, a user-configurable timer, Auto Rstrt Delay (175) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault resets and the drive restarts.
②	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault resets on power up after repair.
③	User-Configurable	These faults can be enabled/disabled to either annunciate or ignore a fault condition using Fault Config 1 (238).
④	Normal Fault	The fault is resettable using normal fault clearing mechanisms on the drive (Stop/Reset button, powercycling, etc.) or through VS Utilities.

The drive indicates faults in the following ways:

- Status LEDs on the drive control panel (see Determining Drive Status Using the Status LEDs on page 196).
- Drive status parameters Drive Status 1 (209) and Drive Status 2 (210).
- Entries in the fault queue (see About the Fault Queue on page 202).
- Pop-up screen on the OIM. See Figure 81. The screen displays:
  - Fault number
  - Fault name
  - Time that has elapsed since fault occurred.

Figure 81 - Sample Fault Screen on the OIM



The fault screen is displayed until it is acknowledged by pressing any F-key or cleared in the drive by other means.

About the Fault Queue

The drive automatically retains a history of faults that have occurred in the fault queue. The fault queue is accessed using the OIM or VS Utilities software.

The fault queue holds the eight most recent faults. The last fault to occur is indicated in queue entry #1. As new faults are logged into the queue, existing fault entries are shifted (for example, entry #1 moves to entry #2). Once the queue is full, older faults are discarded from the queue as new faults occur.

All entries in the fault queue are retained if power is lost.

The Time Stamp

For each entry in the fault queue, the system also displays a fault code and time stamp value. The time stamp value is the value of an internal drive-under-power timer at the time of the fault. The value of this timer is copied to PowerUp Marker (242) when the drive powers up. The fault queue time stamp can then be compared to the value in PowerUp Marker to determine when the fault occurred relative to the last drive power up.

The time stamp is cleared when the fault queue is cleared.

See Accessing the Fault Queue on page 226 for information on accessing the fault queue using the OIM. Refer to the VS Utilities Getting Results Manual, publication D2-3488, for information on accessing the fault queue using VS Utilities software.

Clearing Faults

A fault condition can be cleared by the following:

1. Press ESC/PROG or any F-Key to acknowledge the fault and remove the fault pop-up from the OIM screen.
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.
3. After corrective action has been taken, clear the fault using one of the following:
   - Setting Fault Clear (240) to Clear Faults (1).
   - Issuing a Stop-Clear Faults command from the control device (such as an OIM). This action only succeeds if the clear faults function for that device is enabled using the Logic Mask (276) and Fault Clr Mask (283).

Resetting faults clears the faulted status indication. If any fault condition still exists, the fault is latched, and another entry made in the fault queue.

Note that performing a fault reset does not clear the fault queue. Clearing the fault queue is a separate action. See the Fault Clear (240) parameter description.

Fault Descriptions and Corrective Actions

IMPORTANT Read all faults from the inverter. Although rectifier faults occur, they are displayed on the inverter.

Frame 3 Fault Descriptions and Corrective Actions

Table describes drive faults and corrective actions for Frame 3 (firmware version 1.x only). It also indicates if the fault is:

① Auto-resettable, and can also be reset using normal fault clearing mechanisms

② Non-resettable

③ User-configurable, and can be reset using normal fault clearing mechanisms

④ Normal fault*

*The fault is resettable using normal fault clearing mechanisms on the drive (Stop/Reset button, powercycling, etc.) or through VS Utilities.

Table 21 - Fault Descriptions and Corrective Actions (Frame 3)

Fault	No.	Type	Description	Action
AC Line Lost	227	④	Input power Lost, rectifier Ride Through Ena (64) is set to Disabled.	1. Verify proper input voltage. 2. Use rectifier parameters Line Frequency (1), Input Voltage RS (7), Input Voltage ST (8), and Input Voltage TR (9) to verify that drive can accurately measure input frequency and voltage. 3. Check line voltage feedback signal path, including line sync board with fuse, AC Line I/O board, and rectifier control board.
Analog In Loss	29	①	A user-configurable analog input is configured to fault on signal loss. A signal loss has occurred. Configure with inverter Analog In 1, 2 Loss (324, 327).	1. Check parameters. 2. Check for broken/loose connections at inputs.
Auto Rstrt Tries	33	③	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of inverter Auto Rstrt Tries (174). Enable/disable with inverter Fault Config 1 (238).	Correct the cause of the fault and manually clear.
AutoTune Aborted	80	④	You canceled the autotune procedure.	Restart procedure.
Auxiliary Input	2	①	A user-configurable digital input is configured to **Aux. Fault** and the input is open.	1. Check digital wiring. 2. Configure the digital input to something else with inverter Digital In Sel parameter (361...366).
CarrierSync Lost	247	③	Rectifier could not maintain carrier synchronization to inverter. Configure with rectifier Fault Config (rectifier 238).	1. Set inverter PWM Frequency (inverter 151) to 4 KHz. 2. Check cabling between two control boards. 3. Replace rectifier control board. 4. Replace inverter control board.
Current Fbk Lost	35	④	The magnitude of motor current feedback was less than 5% of inverter Motor NP FLA (42) for the time configured in inverter Imbalance Time (50). Detection of this fault is disabled when inverter Imbalance Time (50) is set to the maximum value of 10.0 seconds.	1. If motor current rating is significantly less than drive output rating, it may be necessary to disable this fault by setting inverter Imbalance Time (50) to 10.0 seconds. 2. Verify connection of current feedback device and motor terminals. 3. If fault repeats, replace current feedback devices and/or power supply.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage. Enable/disable with inverter Fault Config 1 (238).	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or extend deceleration time.
Drive OverLoad	64	①	Drive output rating of 110% for 1 minute or 150% for 5 seconds has been exceeded.	Reduce load or extend inverter Accel Time (140, 141).
Excessive Load	79	④	Motor did not come up to speed in the allotted time.	1. Uncouple load from motor. 2. Repeat Autotune (inverter 61).
FluxAmpsRef Rang	78	④	The value for flux amps determined by the autotune procedure exceeds the programmed inverter Motor NP FLA (42).	1. Reprogram inverter Motor NP FLA (42) with the correct motor nameplate value. 2. Repeat Autotune (inverter 61).
Ground Fault	13	①	A current path to earth ground in excess of 7% of drive rated amps has been detected at one or more of the drive output terminals.	Check the motor and external wiring to the drive output terminals for a grounded condition. See inverter Ground Current (21).
Hi Vdc Shunt	15	④	Drive has activated the shunt trip because the DC Bus Voltage was above 800V DC for more than 100 ms.	1. Monitor the AC line for high line voltage or transient conditions. 2. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
High AC Line	222	④	Input line voltage is too high.	Reduce input voltage to meet specification of 480 ±10%.
HW Fault	70	④	Inverter section of power structure hardware detected an unexpected fault during power stage diagnostics.	Replace inverter power board.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
I/O Board Fail	122	②	Inverter (Standard) I/O Board failure.	1. Cycle power. 2. If fault repeats, replace inverter standard I/O board.

Table 21 - Fault Descriptions and Corrective Actions (Frame 3) (Continued)

Fault	No.	Type	Description	Action
I/O Comm Loss	121	②	Loss of communication to inverter standard I/O board.	1. Cycle power. 2. If fault persists, verify connection between inverter I/O board and inverter control board. 3. If fault still persists, replace inverter standard I/O board. 4. If fault still persists, replace inverter control board.
I/O Mismatch	120	④	Incorrect inverter I/O board identified.	Restore inverter I/O board to original configuration, or If new configuration is desired, reset fault.
Incompat MCB-PB	106	②	Drive rating information stored on the inverter power board is incompatible with the inverter Control board firmware.	Load compatible version files into inverter.
Input I Imbalance	225	④	Input phase current imbalance exceeded limits.	1. Fault 225 can occur if rectifier Line I Imbalance (22) is greater than rectifier I Imbalance Lmt (62) for longer than the time in rectifier I Imbalance Time (63). Verify that rectifier parameters 62 and 63 have the correct values. If this is the cause of the fault 225, fault 225 should also appear in the rectifier fault queue (rectifier parameters 243...250). 2. Check for line voltage imbalance. A line voltage imbalance can cause a line current imbalance. See rectifier Line V Imbalance (23). 3. Check for existence of rectifier instantaneous overcurrent (IOC) faults (rectifier faults 12, 211, 212, 213) in rectifier fault queue (rectifier parameters 243...250). Short duration events on AC line can cause rectifier overcurrents, which can be reported as drive fault 225. See description of rectifier IOC Redir Time (rectifier 300) and IOC Redir Max (rectifier 301). 4. Check for existence of rectifier Line V Imbal OL fault (rectifier fault 16) in rectifier fault queue (rectifier parameters 243...250). This rectifier fault can be caused by short duration AC line events and is reported as drive fault 225. 5. Check rectifier current feedback wiring and signal path, which includes the rectifier power board and the rectifier control board.
Input V Imbalance	226	④	Rectifier Line V Imbalance (23) exceeded rectifier V Imbalance Lmt (60) for more than the time in rectifier V Imbalance Time (61).	1. Check for problem in input power distribution. 2. Check line voltage feedback wiring and signal path: includes line synchronization board, AC Line I/O board, Rectifier control board.
Inv Shunt Trip	14	④	Drive has activated the shunt trip because the inverter firmware has commanded it. This can be caused by the detection of a motor-side (inverter) ground fault (fault 13), or by the user writing a **1** to bit 0 of inverter Appl Digital Out (inverter 30).	1. See table entry for Ground Fault (13). 2. Determine why a **1** was written to bit 0 of inverter Appl Digital Out (inverter 30).
Invtr Base Temp	8	①	Measured temperature of one of the inverter IGBT modules exceeded limit.	Check for proper temperature and flow rate of coolant.
Invtr Dsat U, V, W	200 201 202	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Invtr Gate Kill	207	④	Inverter gate kill contact is open.	Close gate kill contact.
Invtr HW Unk	230	④	Inverter section of power structure hardware reported unexpected fault.	1. Verify connection between inverter control board and inverter power board. 2. If fault persists, replace inverter power board. 3. If fault still persists, replace inverter control board.
Invtr HW Unused	206	④	Inverter section of power structure hardware reported unexpected fault.	1. Verify connection between inverter control board and inverter power board. 2. If fault persists, replace inverter power board. 3. If fault still persists, replace inverter control board.
Invtr I Offset U, V, W	18 19 20	④	An inverter current feedback offset calculated at drive start was out of range.	Check inverter current feedback signal path.
Invtr IGBT Temp	9	①	Calculated inverter IGBT junction temperature has exceeded its rated maximum. See inverter diagnostic parameter 2, IGBT Junct Temp.	Check for proper temperature and flow rate of coolant.
Invtr Over Cur U, V, W	203 204 205	④	High current was detected in an IGBT.	1. Verify proper motor data is entered. 2. Reduce current limit.

Table 21 - Fault Descriptions and Corrective Actions (Frame 3) (Continued)

Fault	No.	Type	Description	Action
IR Volts Range	77	④	The drive autotuning default is Calculate, and the value calculated for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.
IXo Voltage-Range	87	④	Ixo voltage calculated from motor nameplate data is too high.	1. If Ixo calculation is not needed, disable it by clearing bit 2 of Compensation (inverter parameter 56), then clear fault. 2. If Ixo calculation is needed, re-enter motor nameplate data, and, if necessary, repeat Autotune (inverter 61).
Line Feq Lost	228	④	Line frequency not in the range of 47...63 Hz.	1. Verify line frequency. 2. Check line voltage feedback wiring and signal path: includes line synchronization board, AC Line I/O board, Rectifier control board.
Low DC Bus	223	④	The DC bus voltage is too low.	Verify proper input voltage.
Motor I Imbalance	37	④	The motor current imbalance displayed in inverter Imbalance Count (221) has exceeded inverter Imbalance Limit (49) for time configured in inverter Imbalance Time (50).	Clear fault.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/disable with inverter Fault Config 1 (238).	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by inverter Motor OL Amps (48).
Not At Voltage	237	④	The rectifier did not regulate to the desired bus voltage within the defined time.	1. Verify that rectifier is currently synchronized to the AC line. 2. Check all fuses and cabinet wiring. 3. Replace line sync board. 4. Replace AC Line I/O board. 5. Replace rectifier control board and/or rectifier power board.
OverSpeed Limit	25	①	Functions such as slip compensation or bus regulation have attempted to add an output frequency adjustment greater than that programmed in inverter Overspeed Limit (83).	Remove excessive load or overhauling conditions or increase inverter Overspeed Limit (83).
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
Parameter Chksum	100	②	The calculated checksum does not match the stored checksum for inverter parameter values read from non-volatile memory on the inverter control board. This fault can be cleared by writing a nonzero value to inverter Reset To Defaults parameter (197).	1. Restore inverter defaults using inverter Reset To Defaults parameter (197). 2. Reload user set if used, or reprogram inverter parameters. 3. If fault recurs, replace inverter control board.
Params Defaulted	48	④	The drive was commanded to write default values to all inverter parameters.	1. Clear the fault or cycle power to the drive. 2. Program the drive parameters as needed.
Phase U to Grnd	38	④	A phase-to-ground fault has been detected between the drive and motor in this phase.	1. Check the wiring between the drive and motor. 2. Check motor for grounded phase.
Phase V to Grnd	39	④		
Phase W to Grnd	40	④		
Phase UV Short	41	④	Excessive current has been detected between these two output terminals.	1. Check the motor and drive output terminal wiring for a shorted condition.
Phase VW Short	42	④		
Phase UW Short	43	④		
Port 1...5 Adapter	71 72 73 74 75	④	The network card connected to DPI port stopped communicating on its external network. The fault code indicates the offending port number (71 = port 1, etc.).	1. Check communication board for proper connection to external network. 2. Check external wiring to module on port. 3. Verify external network fault.
Port 1...5 DPI Loss	81 82 83 84 85	④	DPI port stopped communicating via DPI, or an attached peripheral with control capabilities was removed. Fault 82 indicates specifically that the rectifier stopped communicating with the inverter.	1. If DPI device was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, peripherals, communications interface board, or inverter control board as required. 2. If fault 82 occurs, check wiring between communications interface board and the two control boards. Replace communications interface board, rectifier control board, or inverter control board as required.

Table 21 - Fault Descriptions and Corrective Actions (Frame 3) (Continued)

Fault	No.	Type	Description	Action
Power Loss	3	① ③	Input power unavailable or AC line synchronization not possible for longer than inverter Power Loss Time (185). Enable/disable with inverter Fault Config 1 (238).	1. Monitor the incoming AC line for low voltage or line power interruption. 2. Check AC line voltage feedback wiring and signal path. This includes the line synchronization board, the AC Line I/O board, and the rectifier control board.
Power Phased ACB	239	④	Input power is phased ACB rather than ABC.	Switch two of the input power phases.
Precharge Closed	233	④	One or more precharge contactors was closed when it should be open.	1. Check AUX contacts on precharge contactor(s). 2. Check bit 0 in rectifier parameter Dig In Status (216) to view status of input. 3. Check wiring.
Precharge Open	234	④	One or more precharge contactors was open when it should be closed.	1. Check AUX contacts on precharge contactor(s). 2. Check bit 0 in rectifier parameter Dig In Status (216) to view status of input. 3. Check wiring.
Pwr Brd Chksum1	104	④	The checksum read from the inverter power interface board EEPROM does not match the checksum calculated from the EEPROM status data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	②	The checksum read from the inverter power interface board EEPROM does not match the checksum calculated from the EEPROM configuration data.	1. Check connections between inverter control board and inverter power interface board. If this fixes the issue, then use inverter Reset To Defaults (inverter 197) to reset the rectifier to its defaults, then reconfigure the drive as needed. 2. If problem persists, replace inverter power interface board.
Rctfr Base Temp	217	④	Measured temperature of one of the rectifier IGBT modules exceeded limits.	Check for proper temperature and flow rate of coolant.
Rctfr Checksum	229	④	The parameter checksum read from the rectifier control board does not match the checksum calculated, or the rectifier power board or rectifier control board has been replaced.	1. Clear fault. 2. If fault persists, restore defaults on rectifier (rectifier parameter 197), then reprogram rectifier parameters. 3. If fault still persists, replace rectifier control board or rectifier power board.
Rctfr Dsat R, S, T	208 209 210	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Rctfr Gnd Fault	216	④	Excessive input ground current measured.	Check for grounded input wiring.
Rctfr HW Unk	231	④	Rectifier portion of power structure hardware reported unexpected fault.	1. Verify connection between rectifier control board and rectifier power board. 2. If fault persists, replace rectifier power board. 3. If fault still persists, replace rectifier inverter control board.
Rctfr HW Unused	215	④	Rectifier portion of power structure hardware reported unexpected fault.	1. Verify connection between rectifier control board and rectifier power board. 2. If fault persists, replace rectifier power board. 3. If fault still persists, replace rectifier inverter control board.
Rctfr I2T Ovrld	220	④	Long-term current rating of rectifier exceeded.	1. Low input voltage can result in increased current load. Provide proper input voltage to the drive. 2. Verify that rectifier Input Load Amps (106) is set correctly.
Rctfr IGBT Temp	218	④	Excessive calculated rectifier IGBT junction temperature. See rectifier Rctfr IGBT Temp (rectifier 19).	Check for proper temperature and flow rate of coolant.
Rctfr IO Board	236	②	Loss of communication to rectifier I/O board. Rectifier I/O board failure.	1. Clear fault. 2. If fault persists, verify connection between rectifier I/O board and rectifier control board. 3. If fault still persists, replace rectifier I/O board. 4. If fault still persists, replace rectifier control board.
Rctfr IT Overld	219	④	Short-term current rating of rectifier exceeded.	Low input voltage can result in increased current load. Provide proper input voltage to the drive.
Rctfr Not Login	238	④	Rectifier took too long to connect to inverter.	1. Check the cabling between the communications interface and the two control boards. 2. Verify the DPI Data Rate (270) is set to 500K. 3. Connect one DPI device at a time to see if one of the DPI devices is causing the problem. 4. Replace the communications interface. 5. Replace the rectifier control board.
Rctfr Not OK	232	④	A fault was detected on the rectifier but could not be displayed on the inverter.	Look at rectifier parameter 243 to see fault code.

Table 21 - Fault Descriptions and Corrective Actions (Frame 3) (Continued)

Fault	No.	Type	Description	Action
Rctfr Over Cur R,S,T	211 212 213	④	Rectifier overcurrent. See description of rectifier IOC Redir Time (300) and IOC Redir Max (301) for discussion of alternative reporting of rectifier instantaneous overcurrent (IOC) faults.	1. High line current can be caused by high load current. Verify that rectifier overcurrent was not caused by sudden increase in motor (inverter) current. 2. Low input voltage can result in increased current load. Provide proper input voltage to the drive. 3. AC line events such as short duration shorts in the nearby grid can cause sudden line current increases. Verify that such events have not occurred. 4. Verify proper motor data is entered on inverter. 5. Reduce rectifier current limit using rectifier Current Limit parameter (105).
Rctfr Over Volt	224	④	The DC bus voltage is too high.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
Rctfr Pwr Board	235	②	Drive rating information stored on the rectifier power board is incompatible with rectifier application firmware, or drive rating information stored on the rectifier power board was corrupted or could not be read from rectifier power board by rectifier firmware.	1. Check connections between rectifier control board and rectifier power interface board. If this fixes the issue, then use rectifier Reset To Defaults (rectifier 197) to reset the rectifier to its defaults, then reconfigure the drive as needed. 2. Load updated drive rating information onto rectifier. 3. Load updated rectifier application firmware. 4. Replace rectifier power board.
Reactor Temp	214	④	Temperature switch in reactor opened.	Check for proper temperature and fan operation.
Replaced MCB-PB	107	②	Inverter control board or inverter power board was replaced. This fault can be cleared by writing a nonzero value to inverter Reset To Defaults parameter (197).	1. Restore inverter defaults (inverter parameter 197). 2. Reprogram parameters.
Ride Thru Abort	221	④	Input power loss timed out, rectifier Ride Through Ena (rectifier 64) is set to **Enabled**.	1. Verify input power and connections. 2. Check Line Sync board. 3. Check AC Line I/O board.
Shear Pin	63	① ③	Programmed Current Lmt Val (148) has been exceeded. Enabled/disable with inverter Fault Config 1 (238).	Check load requirements and Current Lmt Val (148) setting.
SW OverCurrent	36	①	The drive output current has exceeded the software current limit.	Check for excess load, improper DC boost setting. DC brake volts set too high.
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value of 305V DC. Enable/disable with inverter Fault Config 1 (238).	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	②	The checksum read from the user set does not match the checksum calculated. These faults can be cleared by writing a nonzero value to inverter Save To User Set (199).	Re-save user set using inverter Save To User Set (199).
UserSet2 Chksum	102	②		
UserSet3 Chksum	103	②		

Frame 4 Fault Descriptions and Corrective Actions

Table describes drive faults and corrective actions for Frame 4 (firmware version 2.x only). It also indicates if the fault is:

① Auto-resettable, and can also be reset using normal fault clearing mechanisms.

② Non-resettable

③ User-configurable, and can be reset using normal fault clearing mechanisms.

④ Normal fault*

*The fault is resettable using normal fault clearing mechanisms on the drive (Stop/Reset button, powercycling, etc.) or through VS Utilities.

Table 22 - Fault Descriptions and Corrective Actions (Frame 4)

Fault	No.	Type	Description	Action
AC Line Lost	227	④	Input power Lost, rectifier Ride Through Ena (64) is set to **Disabled**.	1. Verify proper input voltage. 2. Use rectifier parameters Line Frequency (1), Input Voltage RS (7), Input Voltage ST (8), Input Voltage TR (9) to verify that drive can accurately measure input frequency and voltage. 3. Check line voltage feedback signal path, including Combined I/O board and Combined Control board.
Analog In Loss	29	①	A user-configurable analog input is configured to fault on signal loss. A signal loss has occurred. Configure with inverter Analog In 1, 2 Loss (324, 327).	1. Check parameters. 2. Check for broken/loose connections at inputs.
Auto Rstrt Tries	33	③	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of inverter Auto Rstrt Tries (174). Enable/disable with inverter Fault Config 1 (238).	Correct the cause of the fault and manually clear.
AutoTune Aborted	80	④	You canceled the autotune procedure.	Restart procedure.
Auxiliary Input	2	①	A user-configurable digital input is configured to **Aux. Fault** and the input is open.	1. Check digital input wiring. 2. Configure the digital input to something else with inverter Digital In Sel parameter (361...366).
CarrierSync Lost	247	③	Rectifier could not maintain carrier synchronization to inverter. Configure with rectifier Fault Config (rectifier 238).	1. Set inverter PWM Frequency (inverter 151) to 4 KHz. 2. Replace combined control board.
Current Fbk Lost	35	④	The magnitude of motor current feedback was less than 5% of inverter Motor NP FLA (42) for the time configured in inverter Imbalance Time (50). Detection of this fault is disabled when inverter Imbalance Time (50) is set to the maximum value of 10.0 seconds.	1. If motor current rating is significantly less than drive output rating, it may be necessary to disable this fault by setting inverter Imbalance Time (50) to 10.0 seconds. 2. Verify connection of current feedback device and motor terminals. 3. If fault repeats, replace current feedback devices and/or power supply.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage. Enable/disable with inverter Fault Config 1 (238).	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or extend deceleration time.
Drive OverLoad	64	①	Drive output rating of 110% for 1 minute or 150% for 5 seconds has been exceeded.	Reduce load or extend inverter Accel Time (140, 141).
Excessive Load	79	④	Motor did not come up to speed in the allotted time.	1. Uncouple load from motor. 2. Repeat Autotune (inverter 61).
FluxAmpsRef Rang	78	④	The value for flux amps determined by the autotune procedure exceeds the programmed inverter Motor NP FLA (42).	1. Reprogram inverter Motor NP FLA (42) with the correct motor nameplate value. 2. Repeat Autotune (inverter 61).
Ground Fault	13	①	A current path to earth ground in excess of 50% of drive rated amps has been detected at one or more of the drive output terminals.	Check the motor and external wiring to the drive output terminals for a grounded condition. See inverter Ground Current (21).
Hi Vdc Shunt	15	④	Drive has activated the shunt trip because the DC Bus Voltage was above 800V DC for more than 100ms.	1. Monitor the AC line for high line voltage or transient conditions. 2. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
High AC Line	222	④	Input line voltage is too high.	Reduce input voltage to meet specification of 480 ±10%.
HW Fault	70	④	Inverter section of power structure hardware detected an unexpected fault during power stage diagnostics.	Replace power board.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
I/O Comm Loss	121	④	Communication between control board and I/O board has not been established.	1. Clear fault. 2. If fault persists, verify connection between I/O board and control board. 3. If fault still persists, replace I/O board. 4. If fault still persists, replace control board.
Incompat MCB-PB	106	②	Drive rating information stored on the combined power board inverter EEPROM is incompatible with the Combined Control board inverter firmware.	Load compatible version files into inverter.

Table 22 - Fault Descriptions and Corrective Actions (Frame 4) (Continued)

Fault	No.	Type	Description	Action
Input I Imbalance	225	④	Input phase current imbalance exceeded limits.	1. Fault 225 can occur if rectifier Line I Imbalance (22) is greater than rectifier I Imbalance Lmt (62) for longer than the time in rectifier I Imbalance Time (63). Verify that rectifier parameters 62 and 63 have the correct values. If this is the cause of the fault 225, fault 225 should also appear in the rectifier fault queue (rectifier parameters 243...250). 2. Check for line voltage imbalance. A line voltage imbalance can cause a line current imbalance. See rectifier Line V Imbalance (23). 3. Check for existence of rectifier instantaneous overcurrent (IOC) faults (rectifier faults 12, 211, 212, 213) in rectifier fault queue (rectifier parameters 243...250). Short duration events on AC line can cause rectifier overcurrents, which can be reported as drive fault 225. See description of rectifier IOC Redir Time (rectifier 300) and IOC Redir Max (rectifier 301). 4. Check for existence of rectifier Line V Imbal OL fault (rectifier fault 16) in rectifier fault queue (rectifier parameters 243...250). This rectifier fault can be caused by short duration AC line events and is reported as drive fault 225. 5. Check rectifier current feedback wiring and signal path, which includes the combined power board and the combined control board.
Input V Imbalance	226	④	Rectifier Line V Imbalance (23) exceeded rectifier V Imbalance Lmt (60) for more than the time in rectifier V Imbalance Time (61).	1. Check for problem in input power distribution. 2. Check line voltage feedback wiring and signal path: includes Combined I/O board, Combined Control board.
Inv Shunt Trip	14	④	Drive has activated the shunt trip because the inverter firmware has commanded it. This can be caused by the detection of a motor-side (inverter) ground fault (fault 13), or by the user writing a **1** to bit 0 of inverter Appl Digital Out (inverter 30).	1. See table entry for Ground Fault (13). 2. Determine why a **1** was written to bit 0 of inverter Appl Digital Out (inverter 30).
Inv Temp Switch	31	④	The inverter over temperature switch opened.	Verify the connection between TB7-4 and TB7-5 on the I/O board.
Invtr Base Temp	8	①	Measured temperature of one of the inverter IGBT modules exceeded limit.	Check for proper temperature and flow rate of coolant.
Invtr Dsat U+, V+, W+	200 201 202	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Invtr Dsat U-, V-, W-	197 198 199	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Invtr Gate Kill	207	④	Gate kill contact is open.	Close gate kill contact.
Invtr HW Unk	230	④	Inverter section of power structure hardware reported unexpected fault.	1. Verify connections between control board and power board. 2. If fault persists, replace power board. 3. If fault still persists, replace control board.
Invtr I Offset U, V, W	18 19 20	④	An inverter current feedback offset calculated at drive start was out of range.	Check inverter current feedback signal path.
Invtr IGBT Temp	9	①	Calculated inverter IGBT junction temperature has exceeded its rated maximum. See inverter diagnostic parameter 2, IGBT Junct Temp.	Check for proper temperature and flow rate of coolant.
Invtr Over Cur U, V, W	203 204 205	④	High current was detected in an IGBT.	1. Verify proper motor data is entered. 2. Reduce current limit.
Invtr Unk IO Brd	123	④	The I/O board is of a type that is unknown to the inverter firmware. If fault is cleared, analog inputs and outputs are unusable.	1. Verify the I/O Board ID Voltage (354) is correct for this type of I/O board. 2. If ID voltage is not correct, then replace I/O board. If ID Voltage still isn't correct, then replace control board. 3. If ID voltage is correct, verify that current inverter application firmware version can use this type of I/O board. If not, then update inverter application firmware.
IR Volts Range	77	④	The drive autotuning default is Calculate, and the value calculated for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.

Table 22 - Fault Descriptions and Corrective Actions (Frame 4) (Continued)

Fault	No.	Type	Description	Action
IXo Voltage-Range	87	④	Ixo voltage calculated from motor nameplate data is too high.	1. If Ixo calculation is not needed, disable it by clearing bit 2 of Compensation (inverter parameter 56), then clear fault. 2. If Ixo calculation is needed, re-enter motor nameplate data, and, if necessary, repeat Autotune (inverter 61).
Line Freq Lost	228	④	Line frequency not in the range of 47...63 Hz.	1. Verify proper input voltage and frequency. 2. Verify connections to I/O board. 3. If fault persists, replace I/O board.
Low DC Bus	223	④	The DC bus voltage is too low.	Verify proper input voltage.
Motor I Imbalance	37	④	The motor current imbalance displayed in inverter Imbalance Count (221) has exceeded inverter Imbalance Limit (49) for time configured in inverter Imbalance Time (50).	Clear fault.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/disable with inverter Fault Config 1 (238).	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by Motor OL Amps (48).
Not at Voltage	237	④	The rectifier did not regulate to the desired voltage within the defined time.	1. Verify that rectifier is currently synchronized to the AC line. 2. Check all fuses and cabinet wiring. 3. Replace I/O board. 4. Replace control board and/or power board.
NTC Demux Fail	30	④	Control board cannot read temperature information from inverter half of power board.	1. Clear faults. 2. If fault persists, verify connections to power board. 3. If fault still persists, replace power board.
OverSpeed Limit	25	①	Functions such as slip compensation or bus regulation have attempted to add an output frequency adjustment greater than that programmed in inverter Overspeed Limit (83).	Remove excessive load or overhauling conditions or increase inverter Overspeed Limit (83).
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
Parameter Chksum	100	②	The calculated checksum does not match the stored checksum for inverter parameter values read from the non-volatile memory on the control board. This fault can be cleared by writing a nonzero value to inverter Reset To Defaults parameter (197).	1. Restore inverter defaults using inverter Reset To Defaults parameter (197). 2. Reload user set if used, or reprogram inverter parameters. 3. If fault recurs, replace control board.
Params Defaulted	48	④	The drive was commanded to write default values to all inverter parameters.	1. Clear the fault or cycle power to the drive. 2. Program the inverter parameters as needed.
Phase U to Grnd	38	④	A phase-to-ground fault has been detected between the drive and motor in this phase.	1. Check the wiring between the drive and motor. 2. Check motor for grounded phase.
Phase V to Grnd	39	④		
Phase W to Grnd	40	④		
Phase UV Short	41	④	Excessive current has been detected between these two output terminals.	1. Check the motor and drive output terminal wiring for a shorted condition.
Phase VW Short	42	④		
Phase UW Short	43	④		
Port 1...6 Adapter	71 72 73 74 75 76	④	The network card connected to DPI port stopped communicating on its external network. The fault code indicates the offending port number (71 = port 1, etc.)	1. Check communication board for proper connection to external network. 2. Check external wiring to module on port. 3. Verify external network fault.
Port 1...6 DPI Loss	81 82 83 84 85 86	④	DPI port stopped communicating via DPI, or an attached peripheral with control capabilities was removed. Fault 82 indicates specifically that the rectifier stopped communicating with the inverter.	1. If DPI device was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, peripherals, control board as required. 2. If fault 82 occurs, disconnect all external peripherals and cycle power to drive. If fault 82 recurs, replace control board.

Table 22 - Fault Descriptions and Corrective Actions (Frame 4) (Continued)

Fault	No.	Type	Description	Action
Power Loss	3	① ③	Input power unavailable or AC line synchronization not possible for longer than inverter Power Loss Time (185). Enable/disable with inverter Fault Config 1 (238).	1. Monitor the incoming AC line for low voltage or line power interruption. 2. Check AC line voltage feedback wiring and signal path. This includes the Combined I/O board and the Combined Control board.
Power Phased ACB	239	④	Input power is phased ACB rather than ABC.	Switch two of the input power phases.
Precharge Closed	233	④	One or more precharge contactors was closed when it should be open.	1. Check AUX contacts on precharge contactor(s). 2. Check bit 15 in rectifier parameter Dig In Status (216) to view status of input. 3. Check wiring.
Precharge Opened	234	④	One or more precharge contactors was open when it should be closed.	1. Check AUX contacts on precharge contactor(s). 2. Check bit 15 in rectifier parameter Dig In Status (216) to view status of input. 3. Check wiring.
Pwr Brd Chksum1	104	④	The checksum read from the Combined Power board inverter EEPROM does not match the checksum calculated from the EEPROM status data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	②	The checksum read from the Combined Power board inverter EEPROM does not match the checksum calculated from the EEPROM configuration data.	1. Check connections between Combined Control board and Combined Power board. If this fixes the problem, use inverter Reset To Defaults (inverter 197) and rectifier Reset To Defaults (rectifier 197) to reset all drive parameters to defaults, then reconfigure drive as necessary. 2. If problem persists, replace power board.
Rctfr Base Temp	217	④	Measured temperature of one of the rectifier IGBT modules exceeded limits.	Check for proper temperature and flow rate of coolant.
Rctfr Checksum	229	④	The parameter checksum read from the rectifier portion of the control board does not match the checksum calculated, or the control board or power board has been replaced.	1. Clear fault. 2. If fault persists, restore defaults on rectifier (rectifier parameter 197), then reprogram rectifier parameters. 3. If fault still persists, replace control board or power board.
Rctfr DPI Comm	246	④	DPI communications interrupted between inverter and rectifier.	1. Clear fault. 2. If fault recurs or persists, replace control board.
Rctfr Dsat R+, S+, T+	208 209 210	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Rctfr Dsat R-, S-, T-	241 242 243	④	High current was detected in an IGBT.	1. Check for loose connection in IGBT wire harness. 2. Check IGBTs.
Rctfr Gate Kill	240	④	Gate kill contact is open.	Close gate kill contact.
Rctfr Gnd Fault	216	④	Excessive line side (input) ground current measured.	Check for grounded input wiring.
Rctfr HW Unk	231	④	Rectifier portion of power structure hardware reported unexpected fault.	1. Verify connections between control board and power board. 2. If fault persists, replace power board. 3. If fault still persists, replace control board.
Rctfr I2T Ovrld	220	④	Long-term current rating of rectifier exceeded.	1. Low input voltage can result in increased current load. Provide proper input voltage to the drive. 2. Verify that rectifier Input Load Amps (106) is set correctly.
Rctfr IGBT Temp	218	④	Excessive calculated rectifier IGBT junction temperature. See rectifier Rctfr IGBT Temp (rectifier 19).	Check for proper temperature and flow rate of coolant.
Rctfr IO Board	236	④	Communication between control board and I/O board has not been established.	1. Clear fault. 2. If fault persists, verify connection between I/O board and control board. 3. If fault still persists, replace I/O board. 4. If fault still persists, replace control board.
Rctfr IT Overld	219	④	Short-term current rating of rectifier exceeded.	Low input voltage can result in increased current load. Provide proper input voltage to the drive.
Rctfr Not Login	238	④	Rectifier took too long to connect to inverter.	1. Verify the DPI Data Rate (270) is set to 500K. 2. Connect one DPI device at a time to see if one of the DPI devices is causing the problem. 3. Replace the Combined Control board.

Table 22 - Fault Descriptions and Corrective Actions (Frame 4) (Continued)

Fault	No.	Type	Description	Action
Rctfr Not OK	232	④	A fault was detected on the rectifier but could not be displayed on the inverter.	Look at rectifier parameter 243 to see fault code.
Rctfr NTC Demux	244	④	Control board cannot read temperature information from rectifier half of power board.	1. Clear faults. 2. If fault persists, verify connections to power board. 3. If fault still persists, replace power board.
Rctfr Over Cur R, S, T	211 212 213	④	Rectifier overcurrent. See description of rectifier IOC Redir Time (300) and IOC Redir Max (301) for discussion of alternative reporting of rectifier instantaneous overcurrent (IOC) faults.	1. High line current can be caused by high load current. Verify that rectifier overcurrent was not caused by sudden increase in motor (inverter) current. 2. Low input voltage can result in increased current load. Provide proper input voltage to the drive. 3. AC line events such as short duration shorts in the nearby grid can cause sudden line current increases. Verify that such events have not occurred. 4. Verify proper motor data is entered on inverter. 5. Reduce rectifier current limit using rectifier Current Limit parameter (105).
Rctfr Over Volt	224	④	The DC bus voltage is too high.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time.
Rctfr Pwr Board	235	②	Drive rating information stored on the power board is incompatible with rectifier application firmware, or drive rating information stored on the power board was corrupted or could not be read by rectifier firmware.	1. Check connections between Combined Control board and Combined Power board. If this fixes the problem, use inverter Reset To Defaults (inverter 197) and rectifier Reset To Defaults (rectifier 197) to reset all drive parameters to defaults, then reconfigure drive as necessary. 2. Load updated drive rating information onto rectifier. 3. Load updated rectifier application firmware. 4. Replace power board.
Rctfr Unk IO Brd	245	④	The I/O board is of a type that is unknown to the rectifier firmware. If fault is cleared, analog inputs and outputs are unusable.	1. Verify that I/O Board ID Voltage (rectifier 354) is correct for this type of I/O board. 2. If ID voltage is not correct, then replace I/O board. If ID voltage is still not correct, then replace control board. 3. If ID voltage is correct, verify that current rectifier application firmware version can use this type of I/O board. If not, then update rectifier application firmware.
Reactor Temp	214	④	Temperature switch in reactor opened.	Check for proper temperature and fan operation.
Replaced MCB-PB	107	②	Control board or power board was replaced. This fault can be cleared by writing a nonzero value to inverter Reset To Defaults parameter (197).	1. Restore inverter defaults (inverter parameter 197). 2. Reprogram parameters.
Ride Thru Abort	221	④	Input power loss timed out, rectifier Ride Through Ena (rectifier 64) is set to **Enabled**.	1. Verify input power and connections. 2. Check I/O board.
Shear Pin	63	① ③	Programmed inverter Current Lmt Val (148) has been exceeded. Enabled/disable with inverter Fault Config 1 (238).	Check load requirements and inverter Current Lmt Val (148) setting.
SW OverCurrent	36	①	The drive output current has exceeded the software current limit.	Check for excess load, improper DC boost setting. DC brake volts set too high.
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value of: 305V DC input. Enable/disable with inverter Fault Config 1(238).	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	②	The checksum read from the user set does not match the checksum calculated. These faults can be cleared by writing a nonzero value to inverter Save To User Set (199).	Re-save user set using inverter Save To User Set (199).
UserSet2 Chksum	102	②		
UserSet3 Chksum	103	②		

Table 23 - Fault Names Cross-Referenced by Fault Number

No.[1]	Fault
2	Auxiliary Input
3	Power Loss
4	UnderVoltage
5	OverVoltage
7	Motor Overload
8	Invtr Base Temp
9	Invtr IGBT Temp
12	HW OverCurrent
13	Ground Fault
14	Inv Shunt Trip
15	Hi Vdc Shunt
18	Invtr I Offset U
19	Invtr I Offset V
20	Invtr I Offset W
21	Rctfr I Offset R
22	Rctfr I Offset S
23	Rctfr I Offset T
24	Decel Inhibit
25	OverSpeed Limit
29	Analog In Loss
30	NTC Demux Fail [2]
31	Inv Temp Switch [2]
33	Auto Rstrt Tries
35	Current Fbk Lost
36	SW OverCurrent
37	Motor I Imbalance
38	Phase U to Grnd
39	Phase V to Grnd
40	Phase W to Grnd
41	Phase UV Short
42	Phase VW Short
43	Phase WU Short
48	Params Defaulted
63	Shear Pin
64	Drive Overload
70	HW Fault
71...76	Port 1...6 Adapter
77	IR Volts Range
78	FluxAmpsRef Rang
79	Excessive Load
80	AutoTune Aborted
81...86	Port 1...6 DPI Loss
87	IXo VoltageRange
100	Parameter Chksum
101	UserSet1 Chksum
102	UserSet2 Chksum
103	UserSet3 Chksum
104	Pwr Brd Chksum1
105	Pwr Brd Chksum2
106	Incompat MCB-PB
107	Replaced MCB-PB
120	I/O Mismatch[3]
121	I/O Comm Loss
122	I/O Board Fail 3
123	Invtr Unk IO Brd [2]
197...199	Invtr Dsat U-, V-, W- [2]
200...202	Invtr Dsat U, V, W [3]
200...202	Invtr Dsat U+, V+, W+ [2]
203...205	Invtr Over Cur U, V, W
206	Invtr HW Unused [3]
207	Invtr Gate Kill
208...210	Rctfr Dsat R, S, T [3]
208...210	Rctfr Dsat R+, S+, T + [2]
211...213	Rctfr Over Cur R, S, T
214	Reactor Temp
215	Rctfr HW Unused [3]
216	Rctfr Gnd Fault
217	Rctfr Base Temp
218	Rctfr IGBT Temp
219	Rctfr IT Overld
220	Rctfr I2T Overld
221	Ride Thru Abort
222	High AC Line
223	Low DC Bus
224	Rctfr Over Volt
225	Input I Imbalance
226	Input V Imbalance
227	AC Line Lost
228	Line Feq Lost
229	Rctfr Checksum
230	Invtr HW Unk
231	Rctfr HW Unk
232	Rctfr Not OK
233	Precharge Closed
234	Precharge Opened
235	Rctfr Pwr Board
236	Rctfr IO Board
237	Not At Voltage
238	Rctfr Not Login
239	Power Phased ACB
240	Rctfr Gate Kill [2]
241...243	Rctfr Dsat R-, S-, T- [2]
244	Rctfr NTC Demux [2]
245	Rctfr Unk IO Brd [2]
246	Rctfr DPI Comm [2]
247	CarrierSync Lost

(1) Fault numbers not listed are reserved for future use.
(2) Fault available on Frame 4 drives only.
(3) Fault available on Frame 3 drives only.

Diagnostic Parameters

The table below describes the diagnostic parameter values.

Diagnostic Parameter Number	Value Displayed
1	DPI Error Status
2	Calculated IGBT Junction Temperature
3	Active Current Limit
4	Active PWM Frequency
5	Lifetime MegaWatt Hours(1)
6	Lifetime Run Time
7	Lifetime Powered Up Time
8	Lifetime Power Cycles
9	Life MegaWatt Hours Fraction(1)
10	Life MegaWatt Hours Fraction Units(1)
11...99	Reserved for Factory Use

(1) Use the equation below to calculate total Lifetime MegaWatt Hours.

$$\left(\left(\frac{\text{Value of Code 9}}{\text{Value of Code 10}} \times 0.1\right) + \text{Value of Code 5} = \text{Total Lifetime Megawatt Hours}\right)$$

Common Symptoms and Corrective Actions

Table 24 through Table 30 describe common symptoms and corrective actions.

Table 24 - Drive Does Not Start From Start, Run, or Jog Inputs Wired to the Terminal Block

Indication(s)	Cause(s)	Corrective Action
Flashing red Ready LED.	Drive is faulted.	Clear fault: • Press OIM stop key. This action only succeeds if the clear faults function for that OIM is enabled using the Logic Mask (276) and Fault Clr Mask (283). • Cycle power. • Set Fault Clear (240) to 1. • Toggle terminal block stop or terminal block fault reset digital input. This action only succeeds if the clear faults function for that OIM is enabled using the Logic Mask (276) and Fault Clr Mask (283). • Cycle power.
Incorrect operation from the terminal block.	Incorrect input wiring. • 2-wire control requires Run, Run Forward, or Run Reverse input(s). • 3-wire control requires Start and Stop inputs • Jumper from terminal 7 to 8 is required.	Wire inputs correctly and/or install jumper.
	Incorrect digital input programming. • Mutually exclusive choices have been made. • 2-wire and 3-wire programming may be conflicting. • Exclusive functions (for example, direction control) may have multiple inputs configured. • Stop if factory default and is not wired or is open. • Start or Run programming may be missing.	Program Digital In*x* Sel (361...366) for correct inputs.
	The Digital In bit of one or more of the mask parameters (276...285) is not set.	Set the Digital In bit to 1 in the appropriate mask parameters (276...285). The Digital In bit of the Logic Mask (276) must be set if any control function is to be performed from the terminal block.
Flashing yellow Ready LED and DigIn CflctB indication on OIM. Drive Status 2 (210) shows type 2 alarm(s).	Incorrect digital input programming. • Mutually exclusive choices have been made. • 2-wire and 3-wire programming may be conflicting. • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop if factory default and is not wired or is open. • Start or Run programming may be missing.	Program Digital In*x* Sel (361...366) to resolve conflicts. Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Table 25 - Drive Does Not Start or Jog From OIM

Indication	Cause(s)	Corrective Action
None	Drive is programmed for 2-wire control, and the bits of the Logic Mask (276) and Start Mask (277) that apply to the OIM are set to 1.	If 2-wire control is required, no action is necessary. If 3-wire control is required, program Digital In*x* Sel (361...366) for correct inputs.
Flashing or steady red Ready LED.	Active fault.	Reset fault.
Flashing yellow Ready LED.	Enable input is open.	Close terminal block enable input.
	The terminal block stop input is open.	Close terminal block stop input.
	Start inhibit bits are set.	Check status in Start Inhibits (214).

Table 26 - Drive Does Not Respond to Changes in Speed Command

Indication	Cause(s)	Corrective Action
OIM Status Line indicates **At Speed** and output is 0 Hz.	No value is coming from the source of the command.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check Commanded Freq (2) for correct source.
None	Incorrect reference source has been programmed.	1. Check Speed Ref Source (213) for the source of the speed reference. 2. Reprogram Speed Ref A Sel (90) for correct source.
None	Incorrect reference source is being selected via remote device or digital inputs.	1. Check Drive Status 1 (209), bits 12...15 for unexpected source selections. 2. Check Dig In Status (216) to see if inputs are selecting an alternate source. 3. Reprogram digital inputs to correct Speed Sel x option.

Table 27 - Motor and/or Drive Does Not Accelerate to Commanded Speed

Indication	Cause(s)	Corrective Action
Acceleration time is excessive.	Incorrect value in Accel Time **x** (140, 141).	Reprogram Accel Time **x** (140, 141).
Drive is forced into current limit, slowing or stopping acceleration.	Excess load or short acceleration time.	Check Drive Status 2 (210), bit 10 to see if the drive is in current limit. Remove excess load or reprogram Accel Time **x** (140, 141).
Speed command source or value is not as expected.	Improper speed command.	Check for the proper speed command using steps 1...7 in table Table 26.
Programming is preventing the drive output from exceeding limiting values.	Incorrect programming.	Check Maximum Speed (82) and Maximum Freq (55) to insure that speed is not limited by programming.

Table 28 - Motor Operation is Unstable

Indication	Cause(s)	Corrective Action
None	Motor data was incorrectly entered or autotune was not performed.	1. Correctly enter motor nameplate data. 2. Perform static or rotate autotune procedure (61).

Table 29 - Drive Does Not Reverse Motor Direction

Indication	Cause(s)	Corrective Action
None	Digital input is not selected for reversing control.	Check Digital In*x* Sel. Choose correct input and program for reverse.
	Digital input is incorrectly wired.	Check input wiring.
	Direction Mode (190) parameter is incorrectly programmed.	Reprogram Direction Mode (190) for analog bipolar or digital unipolar control.
	Motor wiring is improperly phased for reverse.	Switch two motor leads.
	A bipolar analog speed command input is incorrectly wired or signal is absent.	1. Use meter to check that an analog input voltage is present. 2. Check wiring. Positive voltage commands forward direction. Negative voltage commands reverse direction.

Table 30 - Stopping the Drive Results in a Decel Inhibit Fault

Indication	Cause(s)	Corrective Action
Decel Inhibit fault screen. LCD status line indicates Faulted.	The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation.	1. Reprogram bus regulation (parameters 161 and 162) to eliminate any Adjust Freq selection. 2. Disable bus regulation (parameters 161 and 162) and add a dynamic brake. 3. Correct AC input line instability or add an isolation transformer. 4. Reset drive.

Replacement Parts

Table 31 through Table 34 list the available replacement parts.

Replacement Parts (Frame 3 Drive)

Table 31 - LiquiFlo 2.0 Drive Replacement Parts (Frame 3 Only)

Description	Part Number / Kit Number	Quantity	
		Frame 3AA	Frame 3CC
		180264-A03	180264-A06
AC Contactor - 140 A, 120 V	100-140D11	3	3
AC Contactor (surge suppresor) 110V, 127V	100-DFSC110	3	3
Capacitor Bank Assembly	21T-LCL-CB9 21T-LCL-CB7	1 -	- 1
Line Sync. PC Board Assembly	21T-180043	1	1
Line Sync. Board Cover	21T-179723	1	1
Fuse Block, 30 A, 600 V, Class CC, 2-Line	49454-19B	1	1
Fuse Block, 30 A, 600 V, Class CC, 3-Line	49454-19C	2	2
Lug, 2-600 MCM	Thomas & Betts # ADR60-22D	1	1
115 V Fan, 6” dia.	SK-L1-FAN3-F3	2	2
Transformer, 5 kVA	21T-MISC-B-TR1	1	1
Fuse Holder, 600 V, 30 A	Buss # R60030-2SR	1	1
Precharge Resistor, 47 Ohm, 300W	21T-322542-A02 (set of 3 resistors)	3	3
Resistor, 100 kOhm, 50 W	Dale # RH-50	3	3
Circuit Breaker, Main (Qty 1) 65kAIC (base drive = 1) 100kAIC (option = 0)	21P-CB-A600-65-S 21P-CB-A600-100-S(100kAIC) 21P-CB-A800-65-S 21P-CB-A800-100-S(100kAIC) 21P-CB-A600-HDL (Handle)	1 0 - - 1	- - 1 0 1
Fuse, Class RK-5, 600 V, 15 A	Gould/Shawmut # TRS-R15	2	2
Fuse, Class CC, 600 V, 5 A	Gould/Shawmut # ATQR5	1	1
Fuse, Class CC, 600 V, 1 A	Gould/Shawmut # ATQR1	3	3
Fuse, Class CC, 600 V, 20 A	Gould/Shawmut # ATDR20	3	3
Fuse, Class CC, 600 V, 25 A	Gould/Shawmut # ATQR25	1	1
Terminal Block, 6-Position	49455-93E	1	1
Capacitor Guard Panel	179960	1	1
Plastic Knob	Reid # JCL-555	4	4
460 A Power Module	LF200460AAR	1	-
608 A Power Module	LF200608CCR	-	1
LCD OIM, Door-Mounted	RE1LCD REBZL-N1	1 1	1 1
Air Filter	180415	1	1
Floor Mounting Kit (Optional)	180380-Q01	3	3
Surge Suppressor	21T-385253-A04	1	1
Inductor, 405 Amp	21T-380097-A02	1	-
Inductor, 610 Amp	21T-380097-A04	-	1

Replacement Parts (Frame 3 Power Module)

Table 32 - LiquiFlo 2.0 Power Module Replacement Parts (Frame 3 Only)

Description	Part Number / Kit Number	Quantity	
		LF200460AAR	LF200608CCR
Wire Harness Assembly, Line Sync.	21T-364644-A01	1	1
Wire Harness Assembly, DC Bus Bleeder Resistors	179743-Q02	1	1
Wire Harness Assembly, Gate Driver, Rectifier Side	181770-A01	1	1
Wire Harness Assembly, Gate Driver, Inverter Side	181770-A01	1	1
Current Feedback Device, 1000 A	179701	6	6
Wire Harness Assembly, Current Feedback Device	363874-A01	1	1
Rectifier Control Assembly	21T-180063-A01	1	1
AC Line I/O Assembly	21T-180090-A01	1	1
Inverter Control Assembly	21T-180064-A01	1	1
Connector, Terminal Block, 32-pin	SK-G9-TB1-S1-A	2	2
Internal Fan	21T-181775-A01	1	1
Rectifier Power Interface Assembly, 440 A, (2) 300 A Modules 608 A, (2) 450 A Modules	 21T-351839-A04 21T-351839-A05	 1 -	 - 1
Inverter Power Interface Assembly, 460 A, (2) 300 A Modules 608 A, (2) 450 A Modules	 21T-351893-A04 21T-351893-A05	 1 -	 - 1
Insulation Sheet	179700	2	2
80 W Power Supply Assembly	21T-180089-A01	2	2
Terminal Block, 2-position	179745	2	2
Wire Harness Assembly, Power Supply, Upper Gate	363869-A01	2	2
Wire Harness Assembly, Power Supply, Logic	179753	2	2
Wire Harness Assembly, Power Supply, Lower Gate	363880-A01	1	1
Communications Interface Assembly	21T-180062-A01	1	1
Cable Assembly, 20-pin	21M-194706-Q01	1	1
Cable Assembly, 30-pin	179694-Q01	2	2
Cable Assembly, 40-pin	179828-Q01	2	2
Standard I/O Option, 24V Assembly	21T-180060-A01	1	1

Replacement Parts (Frame 4 Drive)

Table 33 - LiquiFlo 2.0 Drive Replacement Parts (Frame 4 Only)

Description	Part Number / Kit Number	Quantity	
		Frame 4CC	Frame 4CC
		180580-A07	180580-A09
AC Contactor - 300 A, 120 V	100-D300ED11	3	3
Capacitor Bank Assembly, 1215 A 905 A	 21T-LCL-CB10 21T-LCL-CB11	 - 1	 1 -
Circuit Breaker, Control, 15 A, 3 ph (Qty 1) 65kAIC (base drive = 1) 100kAIC (option = 0)	 21T-380127-A03 21T-380127-A09	 1 0	 1 0
Fuse Block, 30 A, 600 V, Class CC, 3-Line	117719	2	2
Fuse Block, 30 A, 600 V, Class CC, 2-Line	49454-19B	1	1
Lug, 2-600 MCM, Ground	Thomas & Betts # ADR60-22D	1	1
115 V Fan	SK-L1-FAN3-F3	4	4
Transformer, 5 kVA, Multi-tap	21T-MISC-B-TR1	1	1
Precharge Resistor, 47 Ohm, 300W	21T-322542-A02 (set of 3 resistors)	6	6
Circuit Breaker, Main,1500 A (Qty 1) 65kAIC (base drive = 1) 100kAIC (option = 0)	 21T-380127-A03 21T-380127-A08	 1 0	 1 0
Circuit Breaker Handle and Shaft	21T-CB-A1500-HDL	1	1
Fuse, Class CC, 600 V, 1 A	Gould/Shawmut # ATQR1	3	3
Fuse, Class CC, 600 V, 10 A	Gould/Shawmut # ATQR10	1	1
Fuse, Class CC, 600 V, 20 A	Gould/Shawmut # ATDR20	4	4
Terminal Block, 4-Position	49455-93C	1	1
Terminal Block, 10-Position	49455-93J	2	2
900 A Power Module	21T-LF200900CCR	1	-
1215 A Power Module	21T-LF201215CCR	-	1
Inductor, 905 A	21T-380097-A05	1	-
Inductor, 1215 A	21T-380097-A06	-	1
Surge Suppressor	21T-385253-A01	1	1

Replacement Parts (Frame 4 Power Module)

Table 34 - LiquiFlo 2.0 Power Module Replacement Parts (Frame 4 Only)

Description	Part Number / Kit Number	Quantity	Quantity
		LF200900CCR	LF201215CCR
Combined Power PCB Assembly, 900 A	21T-316972-A02	1	-
Combined Power PCB Assembly, 1215 A	21T-316972-A01	-	1
Wire Harness Assembly, Gate Driver	181565-C04 (L1 - two of each) 181565-C05 (L2 - two of each) 181565-C06 (L3 - two of each)	2	2
Internal Fan, 24V DC (internal to power module)	21T-181775-A02	1	1
Internal Fan, 24V DC (on bottom of power module)	21T-181775-A03	2	2
Wire Harness Assembly, Internal Fan	180316-Q01	1	1
Wire Harness Assembly, Gate Driver, Rectifier Side	180427-Q01	1	1
Wire Harness Assembly, DC Power	180427-Q02	1	1
Current Feedback Device, 1000 A	180307-Q01	1	1
Wire Harness Assembly, DC Bus Resistors	180315-Q02	1	1
Current Feedback Device, 2000 A	179757-Q01	6	6
Wire Harness Assembly, Current Feedback Device, Rectifier Side	181566-C03	1	1
Wire Harness Assembly, Current Feedback Device, Inverter Side	181566-C04	1	1
Wire Harness Assembly, RTD, Rectifier Side	181567-C03	1	1
Wire Harness Assembly, RTD, Inverter Side	181567-C04	1	1
Cable Assembly, 40-pin	179828-Q01	2	2
Combined Control PCB Assembly	21T-180325-A01	1	1
Combined I/O PCB Assembly	21T-180370-A01	1	1
Cable Assembly, 20-pin	194706-Q01	1	1
Cable, Mini DIN, 8-position, Male/Male	180513-Q01	1	1

Ordering Replacement Parts

Order replacement parts available from Rockwell Automation by kit number, when listed. See Figure 2 on page 15 through Figure 7 on page 22 for parts locations.

Board Replacement, Firmware Setup Procedures

This section defines drive firmware setup procedures that are required after a LiquiFlo 2.0 drive board is replaced. If a board is not mentioned in this section, then firmware setup is not required for that board.

Clearing Drive Faults

IMPORTANT The procedure for recovering from a board replacement may cause a drive fault. The appropriate response to many, although not all, of these faults is to clear the fault and continue the procedure. This section gives details on how to clear faults.

1. An Operator Interface Module (OIM) can be used to clear faults if an OIM is available:
   a. Plug the OIM into the appropriate connector on the Communications Interface Board (LiquiFlo 2.0 Frame 3), or Control Board (LiquiFlo 2.0 Frame 4).
   b. The status area at the top of the OIM display should be **Faulted**, and the drive status LED (inverter status LED on the Communications Interface Board [for LiquiFlo 2.0 Frame 3] or the Combined Control Board [for LiquiFlo 2.0 Frame 4]), should be blinking red.
   c. Go to inverter parameter 276 (Logic Mask) and set all the bits to 1.
   d. Go to inverter parameter 283 (Fault Clr Mask) and set all the bits to 1.
   e. Press the stop key on the OIM. This key is normally colored red and is marked **0**.
2. If the fault still exists, remove power to the entire drive, wait 5 minutes, and then restore power.

LiquiFlo 2.0 Frame 3 Firmware Setup Procedures

Inverter Control Board

IMPORTANT If drive fault 106 (Incompat MCB-PB) occurs after replacing board or at any other point during this procedure, then the new inverter control board is incompatible with the older inverter power interface board. Replace the older inverter power interface board.

1. Reset all inverter parameters to defaults by setting inverter parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory. This action should clear faults 100 (Parameter Checksum) and 107 (Replaced MCB-PB).
2. The reset to defaults operation normally causes drive fault 48 (Params Defaulted) to occur. This fault is for information only, and should be cleared. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
3. Reprogram all drive parameters.

Inverter Power Interface Board

IMPORTANT If drive fault 106 (Incompat MCB-PB) occurs after replacing board or at any other point during this procedure, then the new inverter power interface board is incompatible with the older inverter control board. Replace the older inverter control board.

1. Verify that inverter power interface board data is correct by checking inverter read-only parameter 28 (Rated Amps) against correct drive output current rating.
2. Reset all inverter parameters to defaults by setting inverter parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory. This action should clear faults 100 (Parameter Checksum) and 107 (Replaced MCB-PB).
3. The reset to defaults operation normally causes drive fault 48 (Params Defaulted) to occur. This fault is for information only, and should be cleared. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
4. Reprogram all drive parameters.

Rectifier Control Board

IMPORTANT If drive fault 235 (Rctfr Pwr Board) occurs after replacing board or at any other point during this procedure, then the new rectifier control board is incompatible with the older rectifier power interface board, or the data stored on the old rectifier power interface board has become corrupt. Replace the older rectifier power interface board.

1. Reset all rectifier parameters to defaults by setting rectifier parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory.
2. If drive is still faulted, attempt to reset the fault using the normal procedure. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
3. Reprogram all drive parameters.

Rectifier Power Interface Board

IMPORTANT If drive fault 235 (Rctfr Pwr Board) occurs after replacing board or at any other point during this procedure, then the new rectifier power interface board is incompatible with the old rectifier control board, or the data stored on the old rectifier control board has become corrupt. Replace the old rectifier control board. If the fault still exists, replace the new rectifier power interface board.

1. Verify that rectifier power interface board data is correct by checking rectifier read-only parameter 28 (Rated Amps) against correct rectifier output current rating.
2. Reset all rectifier parameters to defaults by setting rectifier parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory.
3. If drive is still faulted, attempt to reset the fault using the normal procedure. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
4. Reprogram all drive parameters.

I/O Board (AC Line I/O Board or Standard I/O Board)

No special actions are required after replacing either of these boards.

LiquiFlo 2.0 Frame 4 Firmware Setup Procedures

Combined Control Board

IMPORTANT If drive fault 106 (Incompat MCB-PB) or fault 235 (Rctfr Pwr Board) occurs after replacing board or at any other point during this procedure, then the new combined control board is incompatible with the old combined power board, or the data stored on the old combined power board has become corrupt. Replace the old combined power board.

1. Reset all inverter parameters to defaults by setting inverter parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory. This action should clear faults 100 (Parameter Checksum) and 107 (Replaced MCB-PB).
2. Reset all rectifier parameters to defaults by setting rectifier parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory.
3. If drive is still faulted, attempt to reset the fault using the normal procedure. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
4. Reprogram all drive parameters.

Combined Power Board

IMPORTANT If drive fault 106 (Incompat MCB-PB) or fault 235 (Rctfr Pwr Board) occurs after replacing board or at any other point during this procedure, then the new combined power board is incompatible with the old combined control board, or the data stored on the old combined control board has become corrupt. Replace the old combined control board. If the fault still exists, replace the new combined power board.

1. Verify that power board inverter data is correct by checking inverter read-only parameter 28 (Rated Amps) against correct drive output current rating.
2. Verify that power board rectifier data is correct by checking rectifier read-only parameter 28 (Rated Amps) against correct rectifier output current rating
3. Reset all inverter parameters to defaults by setting inverter parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory. This action should clear faults 100 (Parameter Checksum) and 107 (Replaced MCB-PB).
4. Reset all rectifier parameters to defaults by setting rectifier parameter 197 (Reset to Defalts) to 1. The value of parameter 197 (Reset to Defalts) returns to 0 immediately after 1 is written to memory.
5. If drive is still faulted, attempt to reset the fault using the normal procedure. See Clearing Drive Faults on page 222. If drive is still faulted after this attempt is made, troubleshoot on the basis of the current fault.
6. Reprogram all drive parameters.

Standard I/O Board Connections

Mount the Standard I/O Board on the Power Module with hardware provided.

Troubleshooting the Drive Using the OIM

The OIM provides immediate visual notification of alarm or fault conditions as well as the following diagnostic information:

- Entries in the fault queue
- Fault parameters
- Drive status parameters
- Selected device version and status information
- OIM version information

Accessing the Fault Queue

As described in About the Fault Queue on page 202, the drive automatically retains a history of the last four faults that have occurred in the fault queue.

To access the fault queue, press the F4 key at the process display screen, or see Figure 82 to access the fault queue from the Main Menu.

Figure 82 - Accessing the Fault Queue

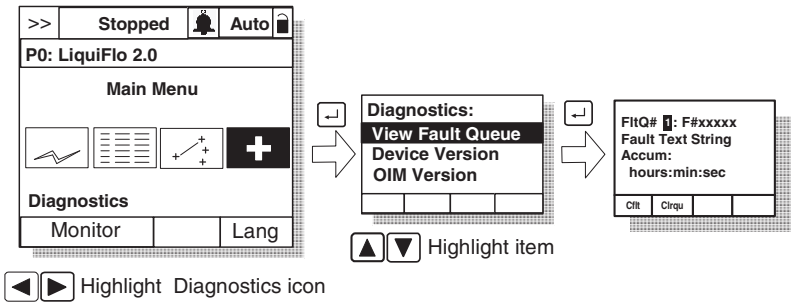
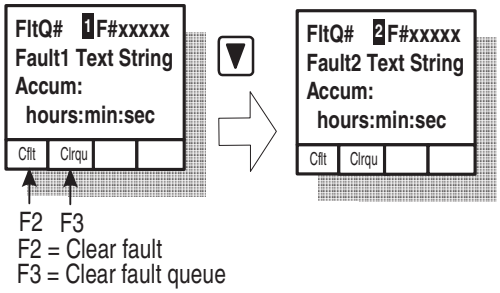


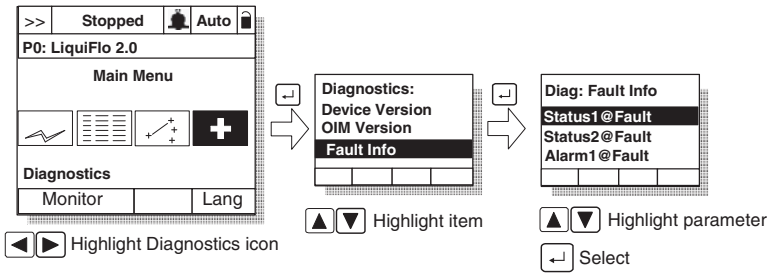
Figure 83 - Sample Fault Queue Entry



Accessing the Fault Parameters

The OIM provides quick access to the fault parameters by grouping them in the Fault Info submenu. To access these parameters, see Figure 84.

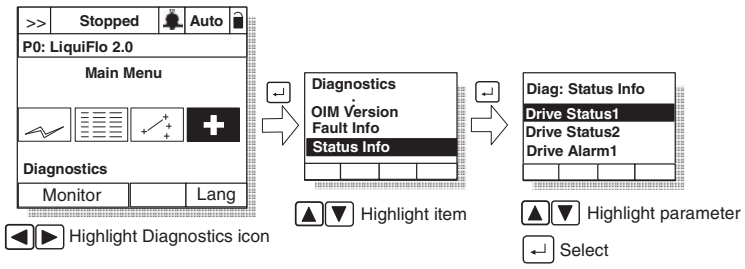
Figure 84 - Accessing the Fault Parameters



Accessing the Drive Status Parameters

The OIM provides quick access to the status parameters by grouping them in the Status Info submenu. To access these parameters, see Figure 85.

Figure 85 - Accessing the Drive Status Parameters



Determining the Product Version

The OIM can be used to determine hardware and firmware version information for the drive and for connected devices, including the OIM, down to the component level.

Device Version on page 228 provides a general procedure for determining device version information for a device, where the **device** is the inverter, the rectifier, or a DPI peripheral device. To use this procedure, first set the OIM to view information for the particular device. See Viewing Rectifier or Inverter Parameters on page 62 for information on setting up the OIM so that it is displaying information related to a particular device.

Device Version

To access the device version information for the current device (inverter, rectifier, or DPI peripheral device), see Figure 86 and Figure 87. This example assumes that the OIM is currently set to view the inverter device, indicated by **P0: LiquiFlo 2.0** on the OIM display. If the OIM is currently viewing the rectifier device, the OIM display contains the line **P2: Active Rectifier**.

Figure 86 - Accessing the Device Version Information

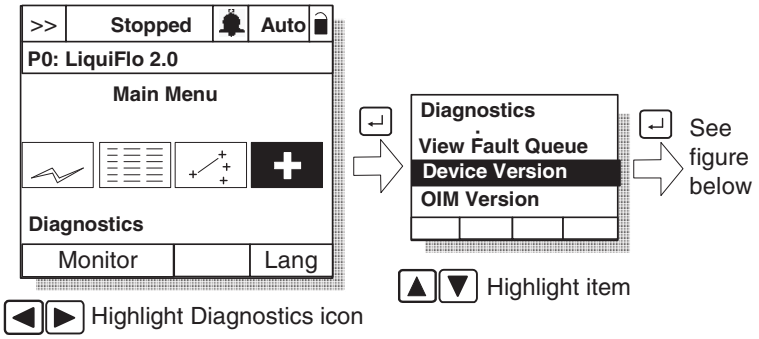
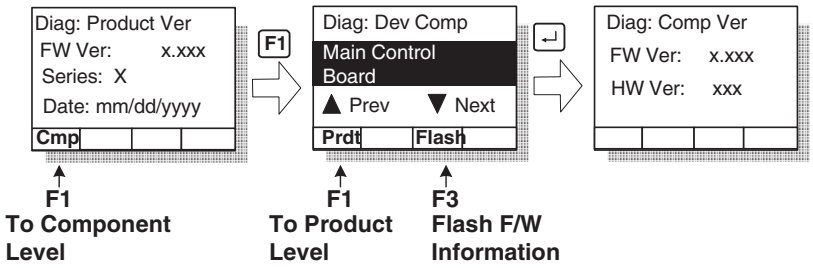


Figure 87 - Device Version Screens at Product and Component Levels



OIM Version

The OIM Version selection provides information on the OIM you are using to access this data. See Figure 88 and Figure 89.

Figure 88 - Accessing the OIM Version Information

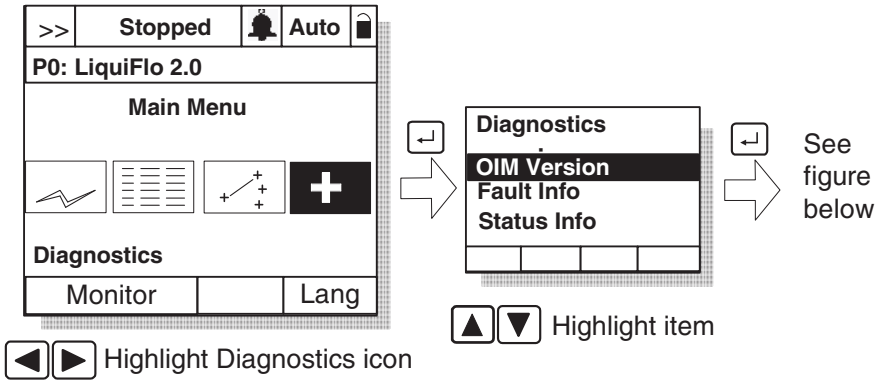
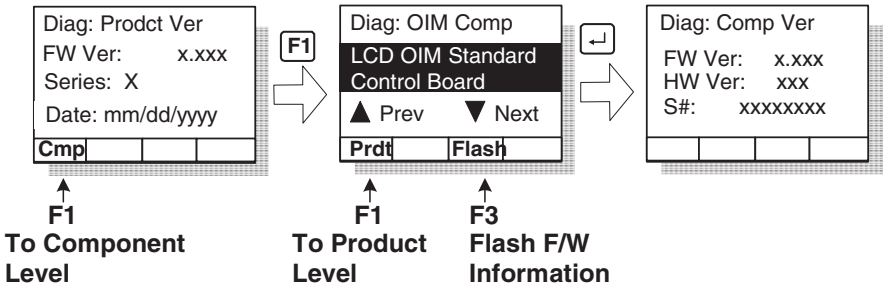


Figure 89 - OIM Version Screens at the Product and Component Levels

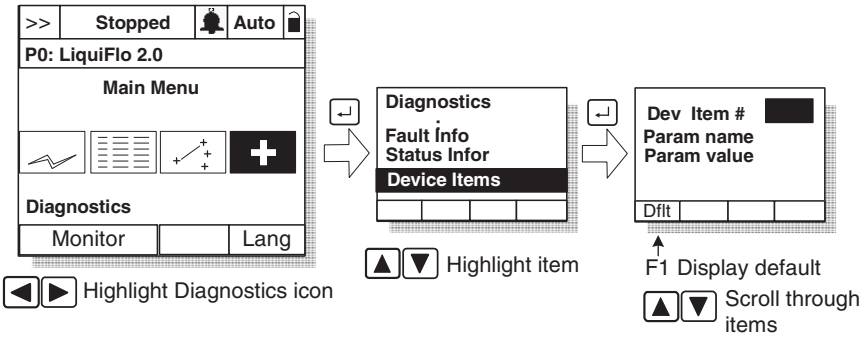


Device Items

The Device Items selection provides access to a list of diagnostic parameters. These parameters should be adjusted by qualified personnel only. See Figure 90.

ATTENTION: The parameters in the Device Items menu must be set by a qualified person who understands the significance of setting them accurately. Failure to observe this precaution could result in bodily injury.

Figure 90 - Accessing the Device Item Information



Checking the Power Modules with Input Power Off

Use the following procedure to check the Power Module circuitry of the drive with power off.

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait 5 minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Turn off and lock out input power. Wait 5 minutes.
2. Verify that there is no voltage at the input power terminals of the drive.
3. Check the DC bus potential with a voltmeter to make sure that the DC bus capacitors are discharged.

4. Disconnect the motor from the drive.
5. Check all AC line and DC bus fuses.
6. If a fuse is open, use a multimeter to check the input diodes and output IGBTs. See Table 35 and Table 36.
7. Reconnect the motor to the drive.
8. Reapply input power.

Table 35 - Input Diode Components

Input Diode No.	Meter Connection (+)	Meter Connection (–)	Component is OK if resistance (R) is:	Component is defective if:
1	*	L1	10 < R < 1 megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity.
2	*	L2		
3	*	L3		
4	*	L4		
5	*	L5		
6	*	L6		
7	L1	**		
8	L2	**		
9	L3	**		
10	L4	**		
11	L5	**		
12	L6	**		

* (+) DC Bus Volts power terminal
** (-) DC Bus Volts power terminal

Table 36 - Output IGBT Components

Output IBGT No.	Meter Connection (+)	Meter Connection (–)	Component is OK if resistance (R) is:	Component is defective if:
1	*	W/T3	10 < R < 1 megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity.
2	*	V/T2		
3	*	U/T1		
4	W/T3	**		
5	V/T2	**		
6	U/T1	**		

* (+) DC Bus Volts power terminal
** (-) DC Bus Volts power terminal

Contacting Technical Support for Assistance

The Tech Support option in the Diagnostics menu provides information regarding technical support.

Also, see Rockwell Automation Support on the back cover of this user manual for technical support contact information.

Notes:

Technical Specifications

Service Conditions

AC Line Distribution System Capacity (maximum) for 480V AC Units	Symmetrical fault current capacity: 85,000 A Short circuit rating if a circuit breaker is used instead of fuses: 65,000 A (optional 100,000 A)
Control Method	Sinusoidal pulse-width-modulated (PWM)
Displacement Power Factor	≥0.99
Line Frequency	50/60 Hz (±2 Hz)
Line Voltage Variation	-10...10%
Motor Lead Lengths	76 m (250 ft) total
Remote Operator Control Wire Length	Up to 1 m (3 ft) from the drive
Analog Speed Reference Resolution	1/4096 (12 bits) 0.025%
Acceleration Adjustment Range	0.1...100.0 seconds (within the ability of current)
Carrier Frequency	2 kHz, 3 kHz, or 4 kHz (software-selectable)
Current Limit Adjustment	25...150% of drive rated amps
Service Factor	1.0
Speed Adjustable Range	From 0 Hz to maximum speed
Speed Regulation	Motor slip dependent
Speed Reference Resolution	0.01 with OIM, ±32767 counts with a network reference
Assembly Max Air Heat Load (Heat Dissipated Into Surrounding Air, approx)	LF2 480V AC Input, 405 A output = approx 1800 W LF2 480V AC Input, 608 A output = approx 2700 W LF2 480V AC Input, 900 A output = approx 4000 W LF2 480V AC Input, 1215 A output = approx 5300 W
Max Input Voltage Imbalance	Service factor = 1.0

Environmental Conditions

Condition	Specification
Operating Temperature (inside NEMA/UL Type 1 enclosure)	0...+55 °C (32...131 °F)
Operating Temperature (outside NEMA/UL Type 1 enclosure)	0…40 ° C (32…104 ° F)
Storage Temperature (ambient)	-40…65 ° C (-40…149 ° F)
Humidity	5...95% (non-condensing)

Cooling System Specifications (Refrigerant)

	LF200460AAR	LF200608CCR	LF200900CCR	LF201215CCR
Max. Input Current (Amps)	405	608	900	1215
Max. Output Current (Amps)	405	608	900	1215
Coolant Temp Range(1)	5...40 °C (41...104 °F)	5...40 °C (41...104 °F)	5...40 °C (41...104 °F)	5...40 °C (41...104 °F)
Minimum Coolant Flow Rate (GPM)	7	7	15	15
Pressure Drop (psig) from Power Module Inlet to Outlet @ Min. Coolant Flow Rate	10	10	10	10
Coolant	WEG25(2)	WEG25(2)	WEG25(2)	WEG25(2)
Max. Inlet Pressure (PSI)	180	180	180	180
Max. Heat Load	6000 Watts	9000 Watts	12,000 Watts	18,000 Watts

(1) Coolant temperature must be above the dew point to prevent condensation. If the water temperature is below the dew point, the appropriate water flow rate control is needed. Consult Rockwell Automation.

(2) WEG25 = good quality or distilled water/ethylene glycol 25% by volume. An approved inhibited, silicate-free ethylene glycol is Ucartherm, a product of Dow Chemical Company.

ATTENTION: Ethylene glycol solutions must be inhibited and silicate-free. Use of uninhibited and silicate-containing solutions can damage the cooling system.

For coolant hardware connections, see Figure 14 on page 37 through Figure 17 on page 40.

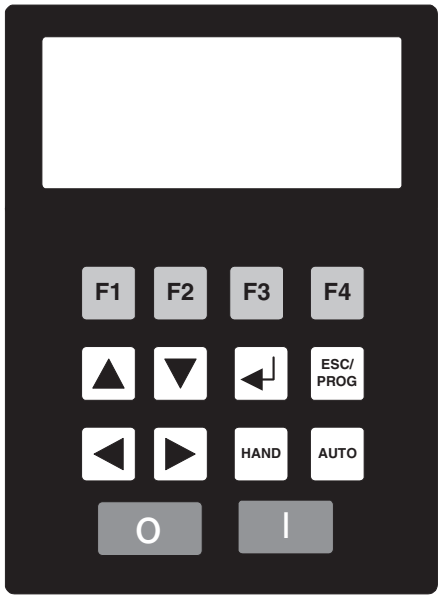
Motor Overload Protection

Condition	Specification
Electronic Motor Overload Protection:	Provides class 10 motor overload protection according to NEC article 430. Does not provide speed sensitive overload protection, thermal memory retention and motor over-temperature sensing according to NEC article 430.126 (A) (2). If such protection is needed in the end-use product, it must be provided by additional means.

Using the OIM

The LCD Operator Interface Module (OIM) is a keypad/display that enables you to program, monitor, and control the drive.

Figure 91 - OIM



Installing and Removing the OIM

A cable (RECBL-LCD) must be used to convert the OIM for hand-held use. The maximum cable length is 9.7 m (32 ft) using extender cables.

To **install** the OIM on a **Frame 3** Power Module, connect the OIM to DPI port 3 on the DPI Communication Interface board until it clicks into place. See Figure 92.

To **install** the OIM on a **Frame 4** Power Module, connect the OIM to the OIM adapter on the lower right corner of the power module. See Figure 93.

To **remove** the OIM, pull back on the OIM cable connector to release the OIM from the DPI Communication Interface board.

Figure 92 - Installing and Removing the Local OIM (Frame 3)

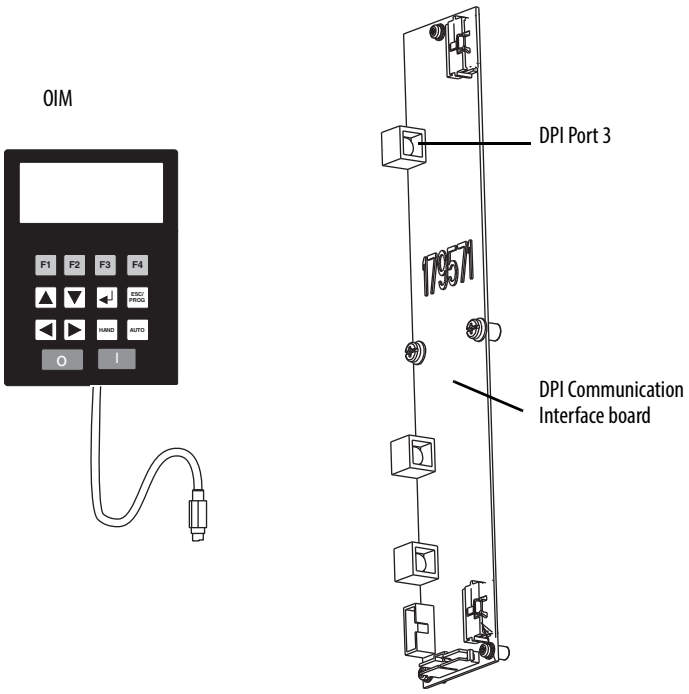
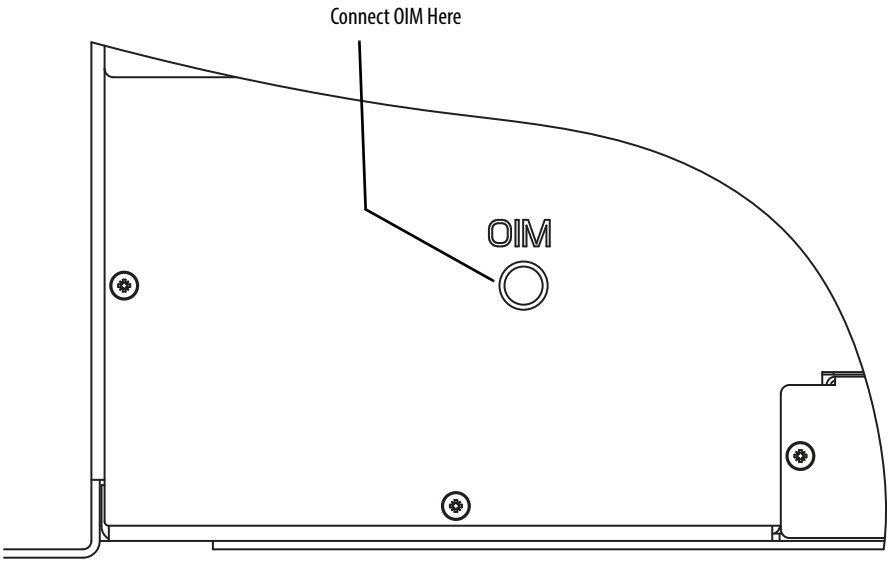


Figure 93 - Installing and Removing the Local OIM (Frame 4)



Removing the OIM While the Drive is Powered

If the OIM **is the selected control source**, removing the OIM while the drive is powered will cause a drive fault.

If the OIM is not the selected control source, but **is the reference source**, removing the OIM while the drive is powered will result in a zero reference value. When the OIM is replaced, the drive will ramp to the reference level supplied by the OIM.

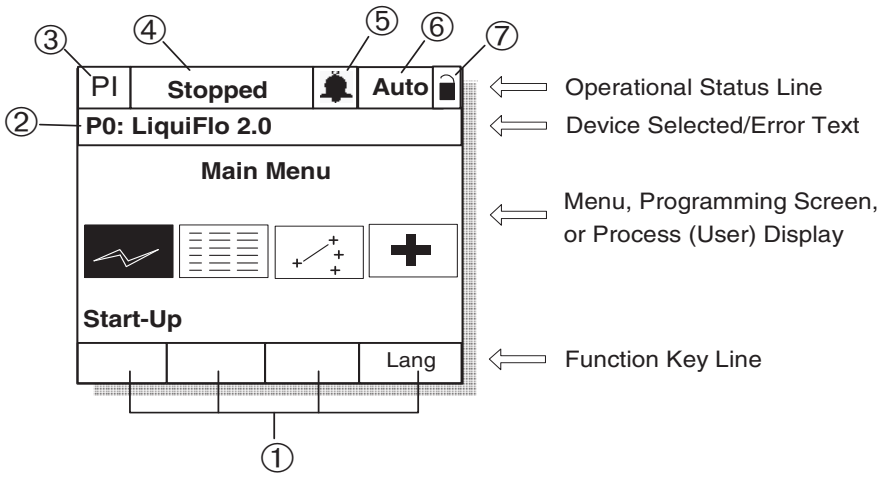
ATTENTION: Removing and replacing the LCD OIM while the drive is running may cause an abrupt speed change if the LCD OIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

If the LCD OIM is not the selected control source or reference source, removing the OIM while the drive is powered will have no effect on drive operation.

Display Description

This section describes the display features and the key functions.

Figure 94 - The Display (Main Menu Shown)



①	Function Key (F1, F2, F3, F4) definitions
✍	Port/peripheral identification. Identifies port or peripheral on DPI about which the OIM is displaying information. See Selecting a Device in the System on page 240.
③	PI loop status: PI = PI control is active.
④	Operating status (for example, Running, Stopped, etc.)
⑤	Alarm annunciation. = Alarm has occurred.
⑥	Auto/Hand mode status.
⑦	Write-protect password status: (unlocked) = password disabled; (locked) = password enabled. See Selecting the Parameter Access Level on page 63.

Key Descriptions

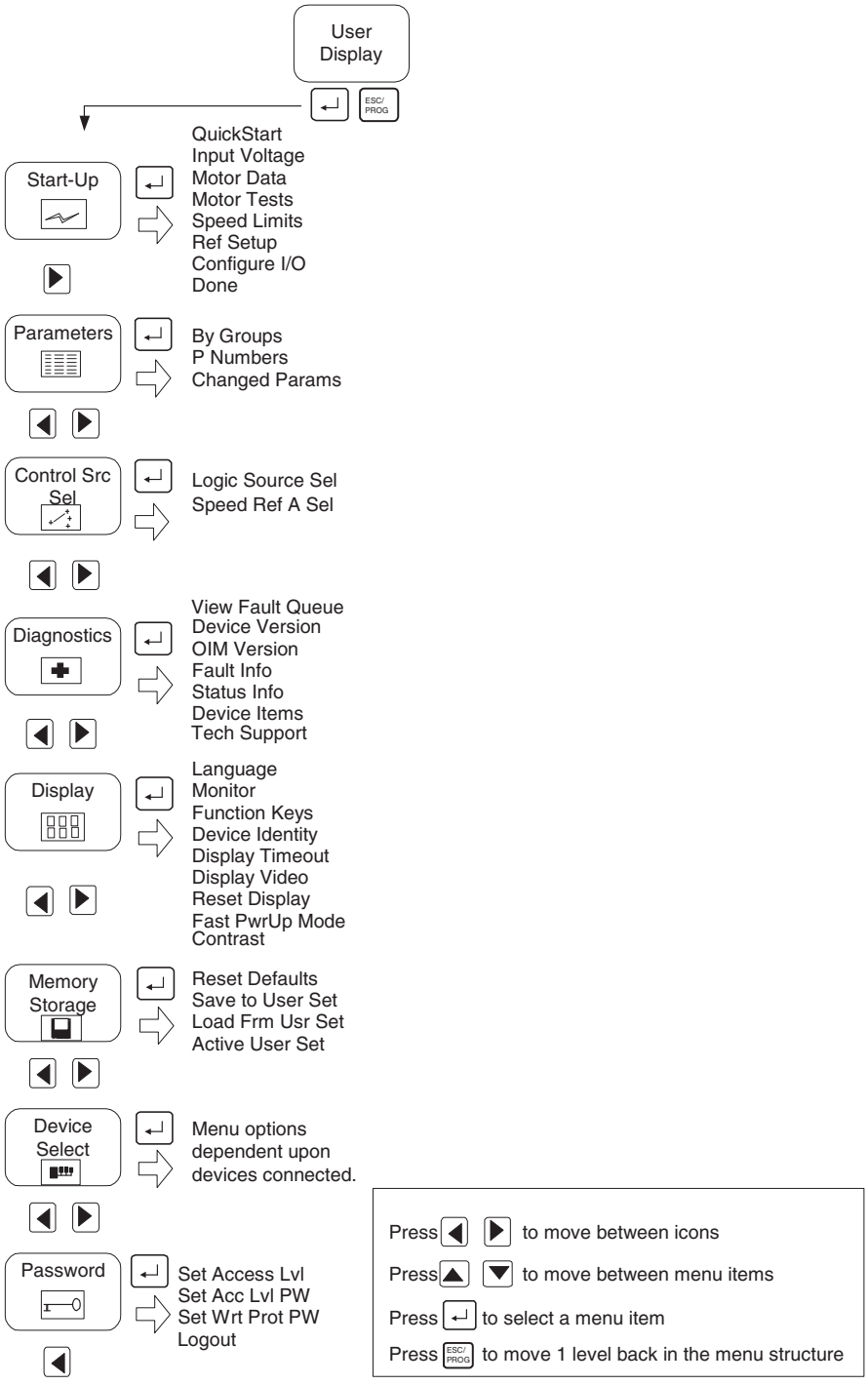
Key	Function
◀	Scroll through options or user function keys, move cursor to the left.
▶	Scroll through options or user functions keys, move cursor to the right.
▲	Scroll through options, increase a value, or toggle a bit.
▼	Scroll through options, decrease a value, or toggle a bit.
ESC/ PROG	Exit a menu, cancel a change to a parameter, or toggle between program and process (user) display screens.
↵	Enter a menu, select an option, or save changes to parameter value
HAND	Enable Hand (manual) reference control.
AUTO	Release Hand (manual) reference control.
○	Stop the drive. Clear a fault if the clear faults function for the OIM is enabled using the Logic Mask (276) and Fault Clr Mask (283).
|	Start the drive if start from the OIM is enabled via the Logic Mask (276) and Start Mask (277).
F1	F1 though F4: Predefined or user-configured functions. The definition of each key is shown directly above the key on the display. See item ① in Figure 94.

ATTENTION: When switching from Auto to Hand, or Hand to Auto, the drive will ramp to the reference level provided by the new source at the rate specified in Accel Time 1 (140), Decel Time 1 (142), Accel Time 2 (141), or Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

OIM Menu Structure

This section describes the OIM menu structure.

Figure 95 - OIM Menu Structure



Powering Up and Adjusting the OIM

The first time the OIM is powered up, you are prompted to select a language for the display text. If the Start-Up routine has not been completed, the Start-Up menu is displayed immediately following the language selection screen.

On subsequent power ups, if both of these requirements have been met, the Main Menu is displayed after the initialization screen.

Selecting the Fast Power Up Feature

The fast power up feature bypasses the initialization screen at power up, and the Main Menu is displayed immediately. To select this feature, select Fast PwrUp Mode from the Display menu.

Adjusting the Screen Contrast

To adjust the screen contrast, select Contrast from the Display menu.

Resetting the Display

To return all the options for the display to factory-default values, select Reset Display from the Display menu.

Selecting a Device in the System

The OIM can access and display data from any active drive or peripheral device on the network. The drive (port 0) is the default device selected.

To select a device, select the Device Select icon from the Main Menu. The options listed depend on what is connected to the network.

The name and DPI port number of the device being accessed is shown on the OIM display (see Figure 94).

Using the OIM to Program the Drive

The OIM enables you to view and adjust parameters in the drive or in peripheral devices connected to the drive. The parameters available for viewing or adjustment depend on the device selected. See Selecting a Device in the System on page 240 for information about selecting a device.

The method of viewing and adjusting parameters is the same regardless of the device selected.

Viewing and Adjusting Parameters

See Chapter 8 for information on how to access the parameters in the drive.

Each parameter screen contains the following information:

- Parameter number
- Parameter name
- Current parameter value and units
- Parameter range
- F1 key defined as a toggle to enable you to view the parameter's current value and the factory-default value

See Figure 96 and Table 37 for instructions on how to adjust the parameter values.

Figure 96 - Adjusting Parameters

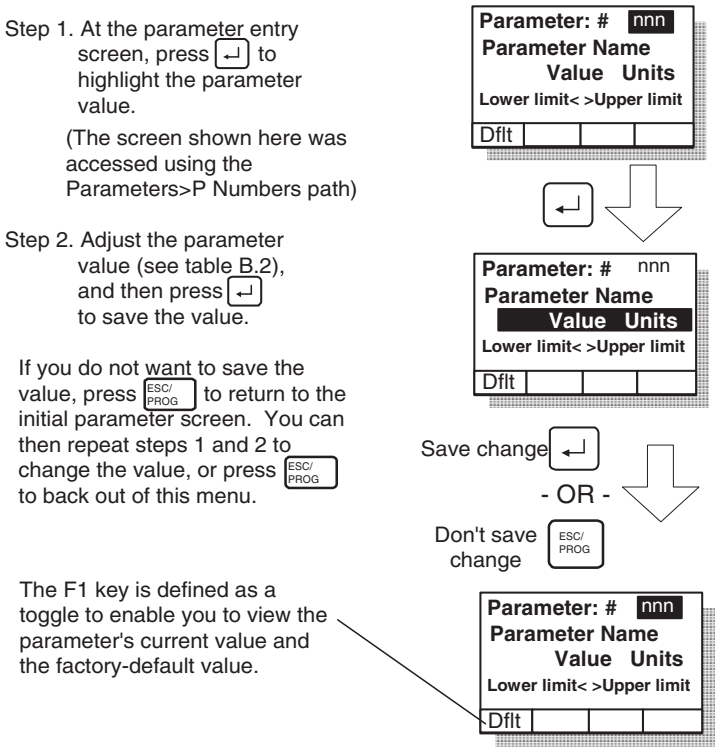

Step 1. At the parameter entry screen, press ↵ to highlight the parameter value.
(The screen shown here was accessed using the Parameters>P Numbers path)
Step 2. Adjust the parameter value (see table B.2), and then press ↵ to save the value.
If you do not want to save the value, press ESC/PROG to return to the initial parameter screen. You can then repeat steps 1 and 2 to change the value, or press ESC/PROG to back out of this menu.
The F1 key is defined as a toggle to enable you to view the parameter's current value and the factory-default value.
Parameter: # nnn
Parameter Name
Value Units
Lower limit< >Upper limit
Dflt
Save change ↵
- OR -
Don't save change ESC/PROG

Table 37 - Adjusting Parameters, Arrow Key Functions

Parameter Type	How to Adjust
Numbered List	Use up/down arrow keys to advance through the list of options.
Bit	Use ◀ ▶ to move the cursor to the bit location you want to change. Use ▲ ▼ to change the value of the bit.
Numeric	Use ▲ ▼ to increase or decrease the value. - Or - Use ◀ ▶ to move the cursor from digit to digit, and use ▲ ▼ to increase or decrease the value of the digit.

To restore all parameters to their factory-default values, select Reset Defaults from the Memory Storage menu.

Note that the parameter values are retained through a line dip or power shutdown.

Loading and Saving User Sets

Drive configurations, called user sets, can be saved and recalled for use at any time. Up to three user sets can be saved in the LiquiFlo drive.

- To **save** the current drive configuration, select Save to User Set from the Memory Storage menu.
- To **recall**, or **load**, a user set, select Load Frm Usr Set from the Memory Storage menu.

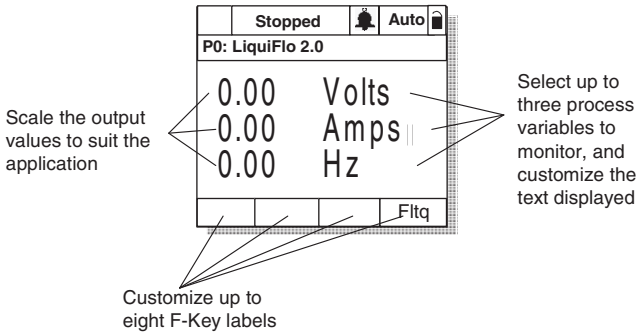
To identify which user set is active, select Active User Set from the Memory Storage menu. The name of the last user set to be loaded into the drive is displayed. **Active Set** means factory defaults have been restored.

Monitoring the Drive Using the Process Display Screen on the OIM

The process display screen enables you to monitor up to three process variables. You can select the display, parameter, scale, and text for each process variable being displayed.

The ESC/PROG key toggles between the programming screen and the process display screen. From the Main Menu screen, press F1 or F2 to select the process display screen. In addition, the process display screen becomes active if no keys have been pressed before the display timeout period expires. See Setting the Display Timeout Period on page 246 for information about setting the display timeout period.

Figure 97 - Process (User) Display Screen

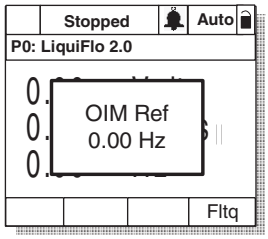


Displaying and Changing the OIM Reference

You can display the reference value that the OIM is sending to the drive by pressing the up or down arrow key once when the process display screen is active. See Figure 98. The OIM reference can be used for the speed reference, PI reference, or trim reference.

To change the displayed reference, press and hold down either the up or down arrow key until the desired value is displayed. Release the key to return to the process display screen.

Figure 98 - OIM Reference Displayed



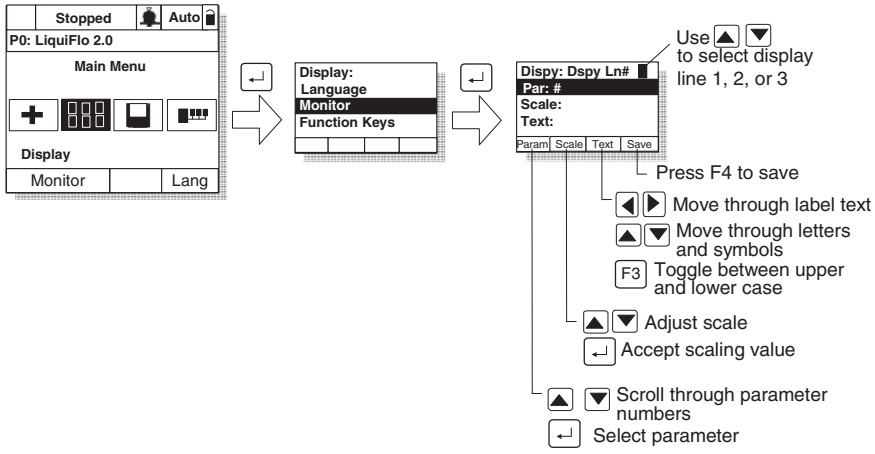
Note that changing the value of the OIM reference does not affect the value of any other port reference.

The value of the OIM reference is saved through a power cycle if parameter 192 (Save OIM Ref) is set to save at power down.

Customizing the Process Display Screen

To customize the process display screen, select Monitor from the Display menu. See Figure 99.

Figure 99 - Customizing the Process Display Screen



Customizing the Function Keys

The function keys (F1, F2, F3, and F4, also called F-Keys) on the OIM can be customized to perform several pre-configured functions when the process display screen is active.

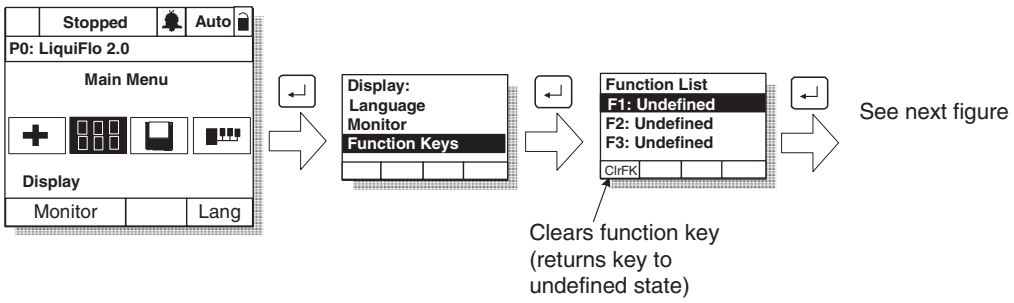
Up to eight function keys can be configured. Pressing ◀ ▶ while the display screen is active toggles between each set of four functions.

As shipped from the factory, the F4 key is configured for the Clear Fault Queue function.

To assign a function to an F-Key, select the Display icon from the Main Menu as shown in Figure 100 and Figure 101.

The F-Key definitions are the same for all OIMs connected to the drive, regardless of the port used.

Figure 100 - Accessing the Function Key Configuration Screens



Select from the list of preconfigured functions:

Undefined (default)

Load User Set 1...3: Loads the specified user set into active drive memory. The drive responds as if a value had been entered in Load Frm User Set (198), or Load Frm Usr Set was selected from the Memory Storage menu of the OIM.

ATTENTION: Loading a user set with LevelSense Start (168) set to Enable can result in the drive starting immediately when all start conditions are met.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Save User Set 1...3: Saves the active configuration to drive memory. The drive responds as if a value had been entered in Save to User Set (199) or Save to User Set was selected from the Memory Storage menu of the OIM.

Acc/Dec Change: Toggles between the display of Acc/Dec rate 1 and Acc/Dec rate 2 (The value the drive is configured to go to, not the current value being used by the drive). This selection is based on the active value of the rate parameters (140...143). Therefore, when any of these parameters change, the actual acc/dec rates will dynamically change.

Preset Speed 1...6: Toggles the selected preset speed on and off and grants Hand (manual) reference control. Returns to Auto reference when the function is toggled.

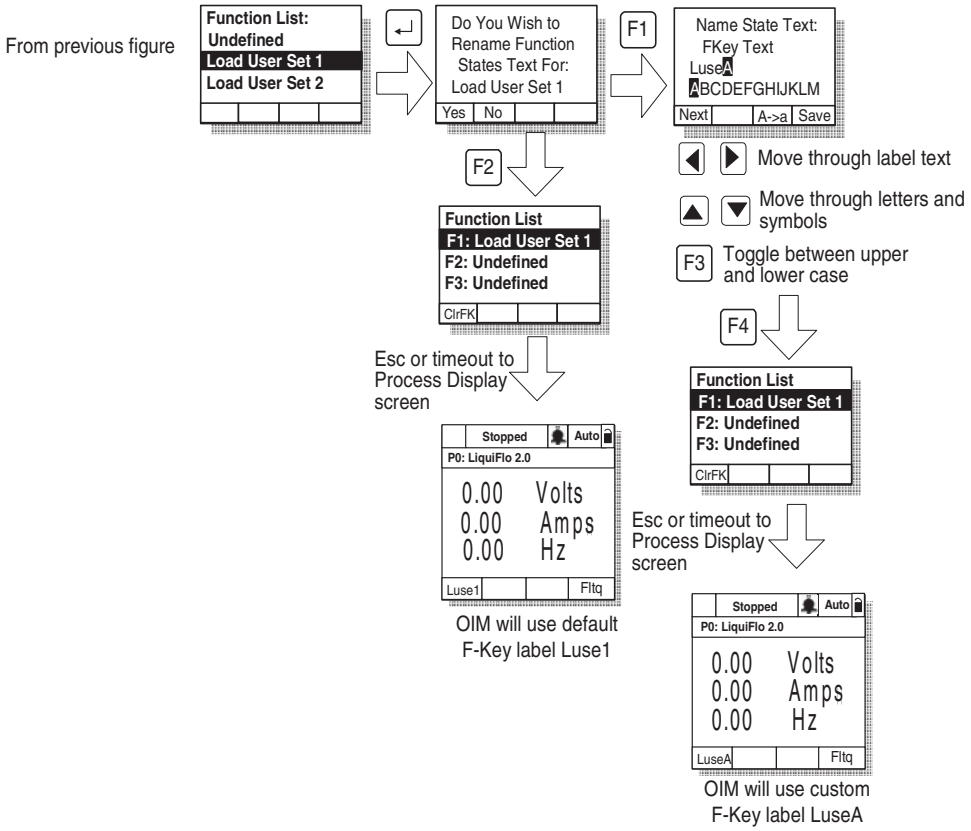
View Fault Queue: Displays the Fault Queue screen (see Accessing the Fault Queue on page 226). Press ESC/PROG to return to the process display screen.

Next: (Reserved for future use.)

Customizing the Function Key Label Text

You can customize the text for each function key label (up to five characters). See Figure 101.

Figure 101 - Customizing the Function Key Label Text



Setting the Display Timeout Period

When the OIM is inactive (that is, no keys have been pressed) for a user-specified period of time, the process display screen becomes active. To return to the previously active screen, press any key. To return to the Main Menu, press ESC/PROG.

To set the display timeout period, select Display Timeout from the Display menu. The timeout period can range from 10...1200 seconds (20 minutes).

This feature can also be disabled by pressing the F1 key while in the display time screen.

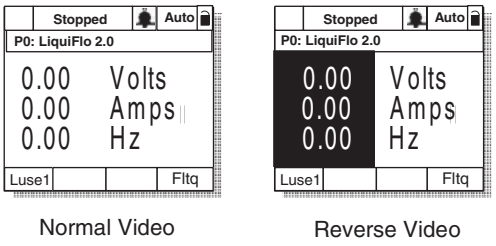
Note that each OIM connected to the drive can have a different timeout period.

Using Reverse Video for the Process Display Screen

To select normal or reverse video for the process display screen, select Display Video from the Display menu. See Figure 102 for sample screens.

Note that each OIM connected to the drive can have a different display mode.

Figure 102 - Selecting Reverse Video for the Process Display Screen



Controlling the Drive From the OIM

The OIM can be used to control the drive:

- Start (Run)
- Stop
- Clear Faults

Starting the Drive

When start from the OIM is enabled using the Logic Mask (276) and Start Mask (277), pressing I issues a start command to the drive.

Stopping the Drive

Pressing O issues a stop command to the drive.

IMPORTANT Stop commands from any attached OIM are always enabled.

LiquiFlo 2.0 Drive Frame 3 Wiring Diagrams

Frame 3 Wiring Diagrams

See the following pages for these LiquiFlo 2.0 wiring diagrams.

Figure 103, Drive Assembly Cabinet Wiring Diagram (Frame 3) on page 248

Figure 104, Power Module Wiring Diagram (Frame 3 - sheet 1) on page 249

Figure 105, Power Module Wiring Diagram (Frame 3 - sheet 2) on page 250

Figure 106, Power Module Rectifier Wiring Diagram (Frame 3 - sheet 3) on page 251

Figure 107, Power Module Inverter Wiring Diagram (Frame 3 - sheet 4) on page 252

Figure 108, Power Module IGBT Wiring Diagram (Frame 3 - sheet 5) on page 253

Figure 103 - Drive Assembly Cabinet Wiring Diagram (Frame 3)

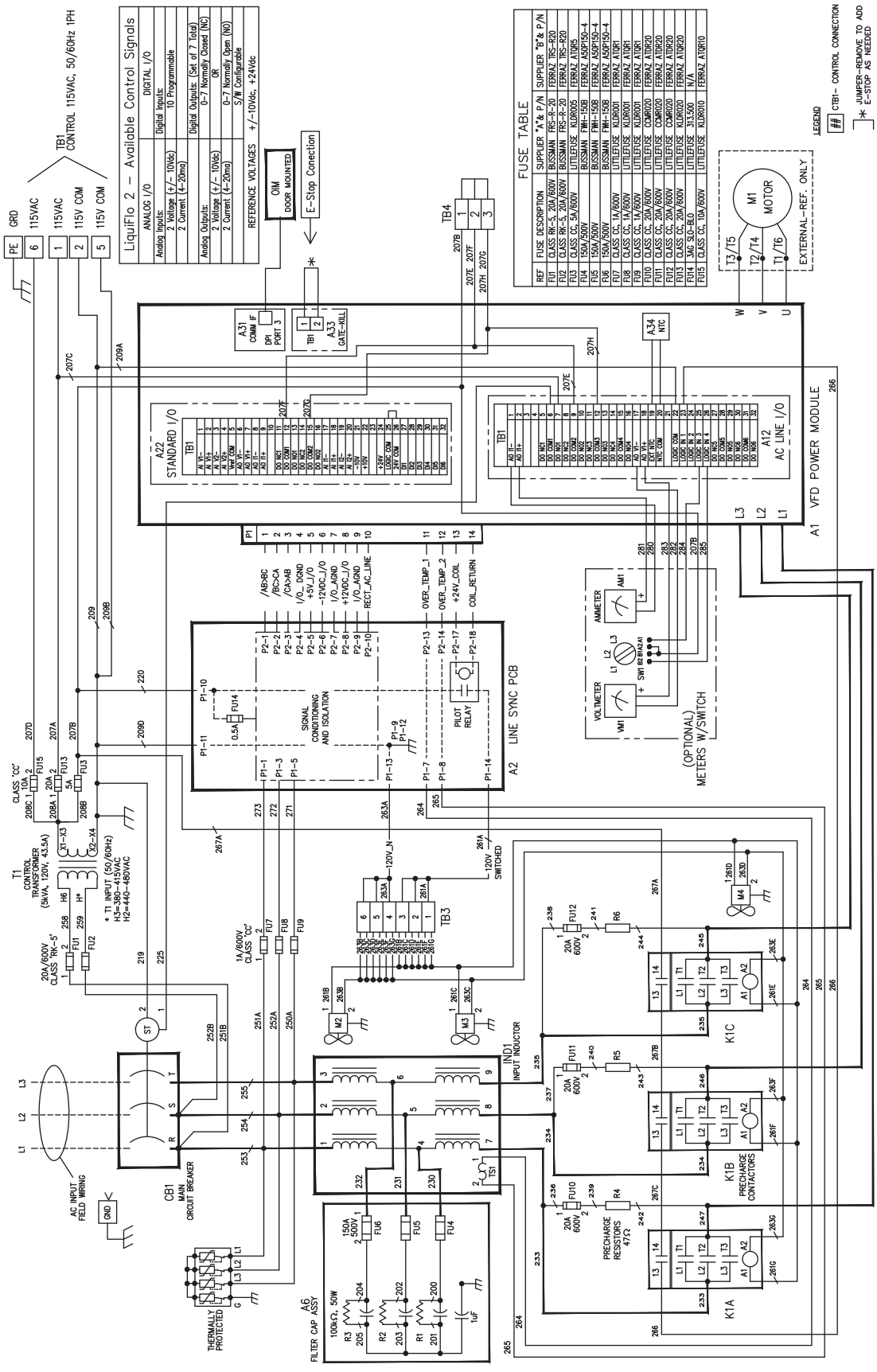


Figure 104 - Power Module Wiring Diagram (Frame 3 - sheet 1)

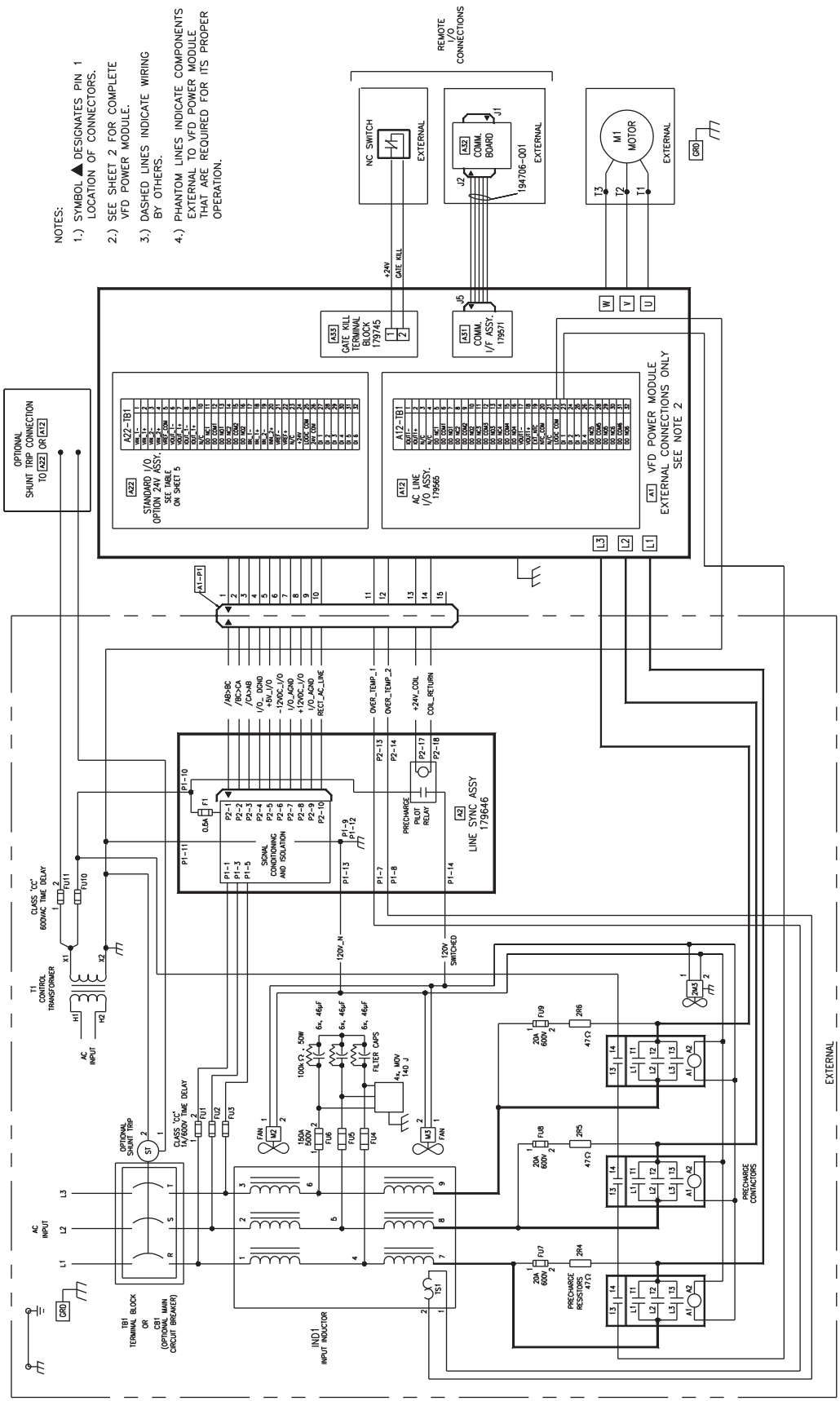
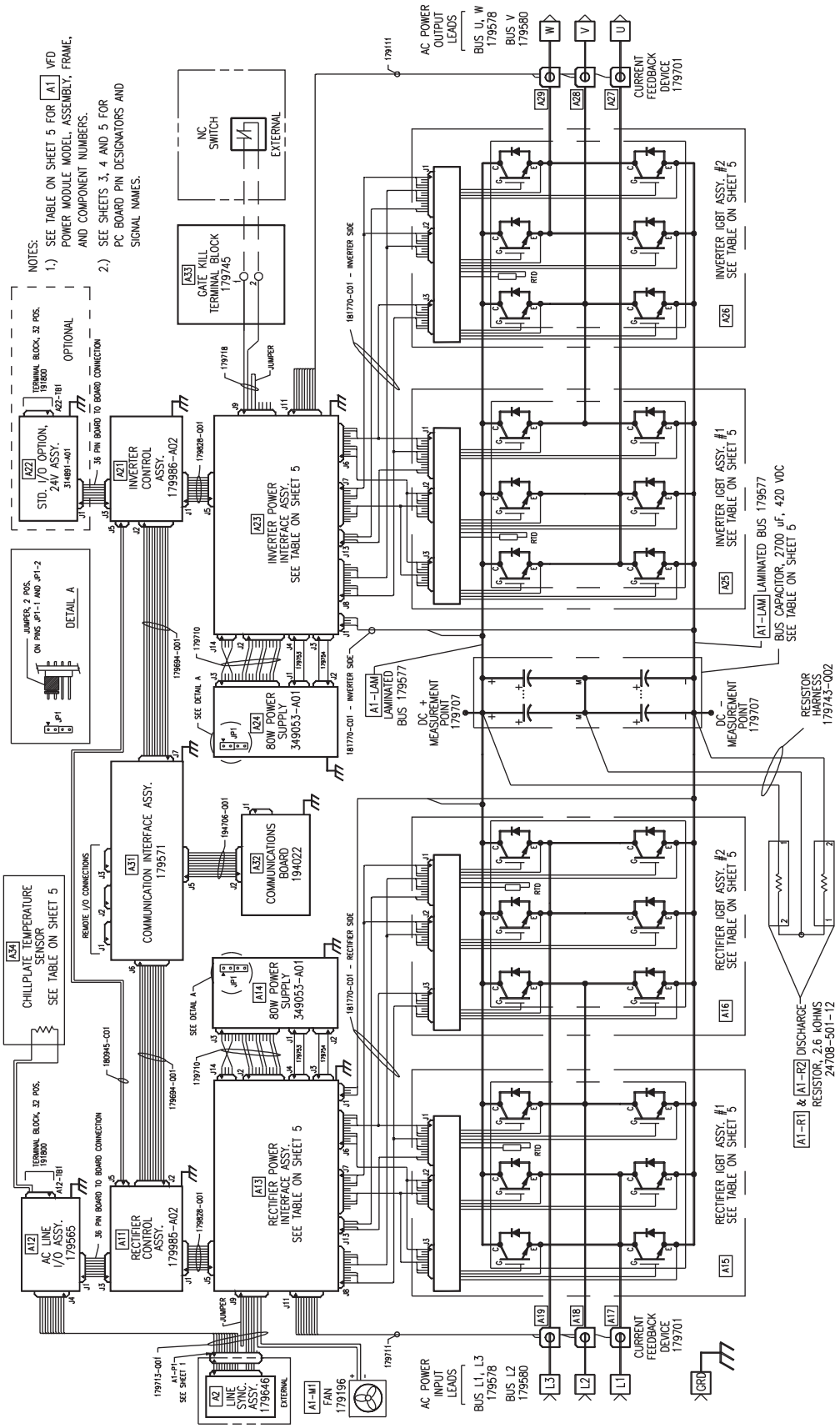

NOTES:
1.) SYMBOL ◀ DESIGNATES PIN 1 LOCATION OF CONNECTORS.
2.) SEE SHEET 2 FOR COMPLETE VFD POWER MODULE.
3.) DASHED LINES INDICATE WIRING BY OTHERS.
4.) PHANTOM LINES INDICATE COMPONENTS EXTERNAL TO VFD POWER MODULE THAT ARE REQUIRED FOR ITS PROPER OPERATION.
REMOTE I/O CONNECTIONS
NC SWITCH
EXTERNAL
A32 COMM. BOARD
194706-001
M1 MOTOR
GRD
+24V GATE KILL
A33 GATE KILL TERMINAL BLOCK 179745
A31 COMM. I/F ASSY. 179571
OPTIONAL SHUNT TRIP CONNECTION TO A22 OR A12
A22 STANDARD I/O OPTION 24V ASSY. SEE TABLE ON SHEET 5
A12 AC LINE I/O ASSY. 179565
A1 VFD POWER MODULE EXTERNAL CONNECTIONS ONLY SEE NOTE 2
A2 LINE SYNC ASSY 179646
SIGNAL CONDITIONING AND ISOLATION
PRECHARGE PILOT RELAY
T1 CONTROL TRANSFORMER
AC INPUT
CLASS "CC" 600VAC TIME DELAY
OPTIONAL SHUNT TRIP
TB1 TERMINAL BLOCK OR CB1 (OPTIONAL MAIN CIRCUIT BREAKER)
IND1 INPUT INDUCTOR
FILTER CAPS
PRECHARGE CONTACTORS
PRECHARGE RESISTORS 47Ω
EXTERNAL

Figure 105 - Power Module Wiring Diagram (Frame 3 - sheet 2)


NOTES:
1.) SEE TABLE ON SHEET 5 FOR A1 VFD POWER MODULE MODEL, ASSEMBLY, FRAME, AND COMPONENT NUMBERS.
2.) SEE SHEETS 3, 4 AND 5 FOR PC BOARD PIN DESIGNATORS AND SIGNAL NAMES.
A22 STD. I/O OPTION, 24V ASSY. 314891-A01
A21 INVERTER CONTROL ASSY. 179986-A02
A23 INVERTER POWER INTERFACE ASSY. SEE TABLE ON SHEET 5
A24 80W POWER SUPPLY 349053-A01
A31 COMMUNICATION INTERFACE ASSY. 179571
A32 COMMUNICATIONS BOARD 194022
A34 CHILLPLATE TEMPERATURE SENSOR SEE TABLE ON SHEET 5
A12 AC LINE I/O ASSY. 179565
A11 RECTIFIER CONTROL ASSY. 179985-A02
A13 RECTIFIER POWER INTERFACE ASSY. SEE TABLE ON SHEET 5
A14 80W POWER SUPPLY 349053-A01
A2 LINE SYNC. ASSY. 179646
A1-M1 FAN 179196
A33 GATE KILL TERMINAL BLOCK 179745
NC SWITCH
EXTERNAL
JUMPER, 2 POS. ON PINS JP1-1 AND JP1-2
DETAIL A
TERMINAL BLOCK, 32 POS. 191800
36 PIN BOARD TO BOARD CONNECTION
REMOTE I/O CONNECTIONS
181770-C01 - INVERTER SIDE
181770-C01 - RECTIFIER SIDE
A1-LAM LAMINATED BUS 179577
A1-LAM LAMINATED BUS 179577
BUS CAPACITOR, 2700 uF, 420 VDC SEE TABLE ON SHEET 5
DC + MEASUREMENT POINT 179707
DC - MEASUREMENT POINT 179707
RESISTOR HARNESS 179743-002
A1-R1 & A1-R2 DISCHARGE RESISTOR, 2.6 kOHMS 24708-501-12
INVERTER IGBT ASSY. #1 SEE TABLE ON SHEET 5
INVERTER IGBT ASSY. #2 SEE TABLE ON SHEET 5
RECTIFIER IGBT ASSY. #1 SEE TABLE ON SHEET 5
RECTIFIER IGBT ASSY. #2 SEE TABLE ON SHEET 5
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AC POWER OUTPUT LEADS
BUS U, W 179578
BUS V 179580
AC POWER INPUT LEADS
BUS L1, L3 179578
BUS L2 179580
179111
179718 JUMPER
179710
179694-001
179695-C01
179713-001
179628-001
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A26
A27
A28
A29
A15
A16
A17
A18
A19

Figure 106 - Power Module Rectifier Wiring Diagram (Frame 3 - sheet 3)

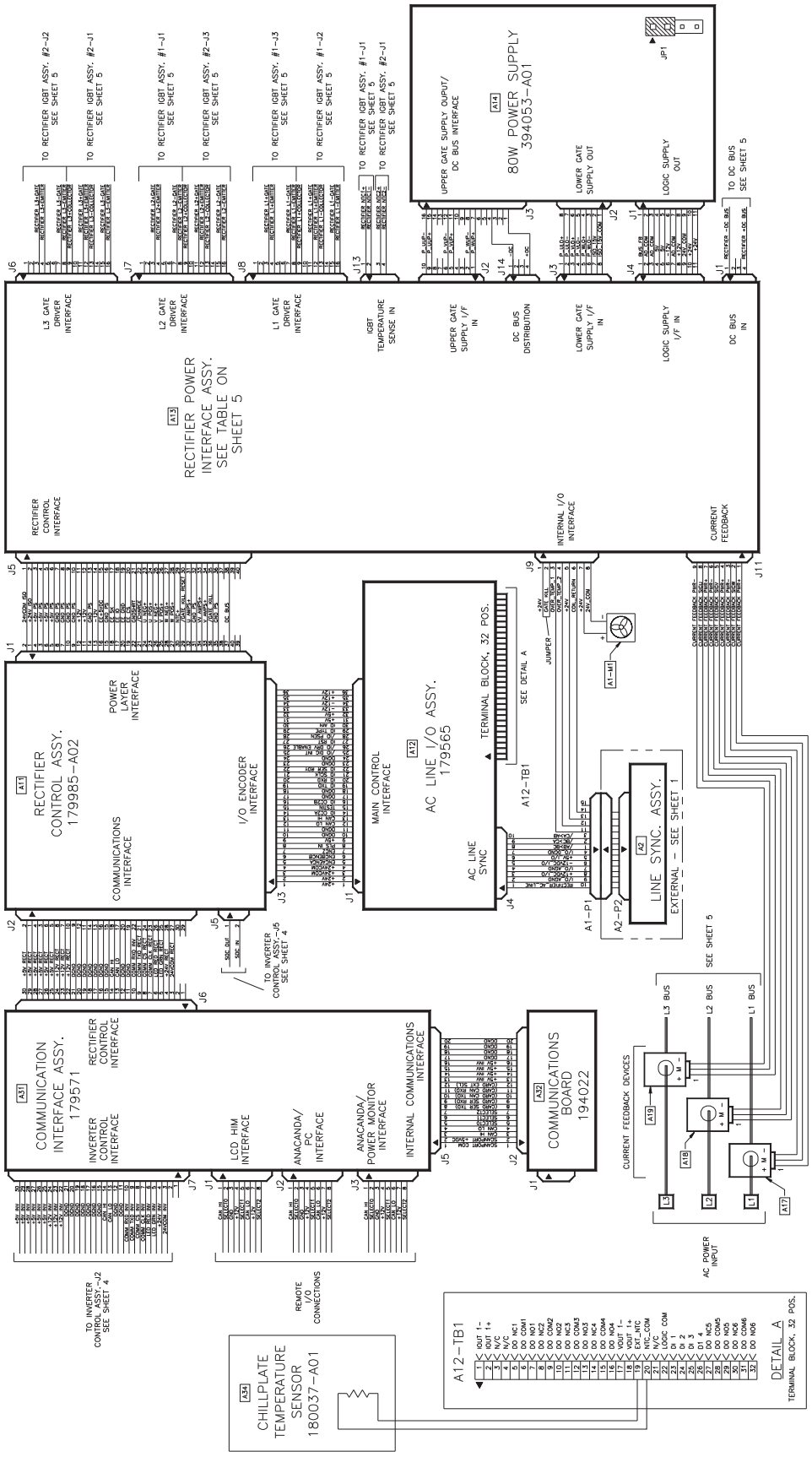


Figure 107 - Power Module Inverter Wiring Diagram (Frame 3 - sheet 4)

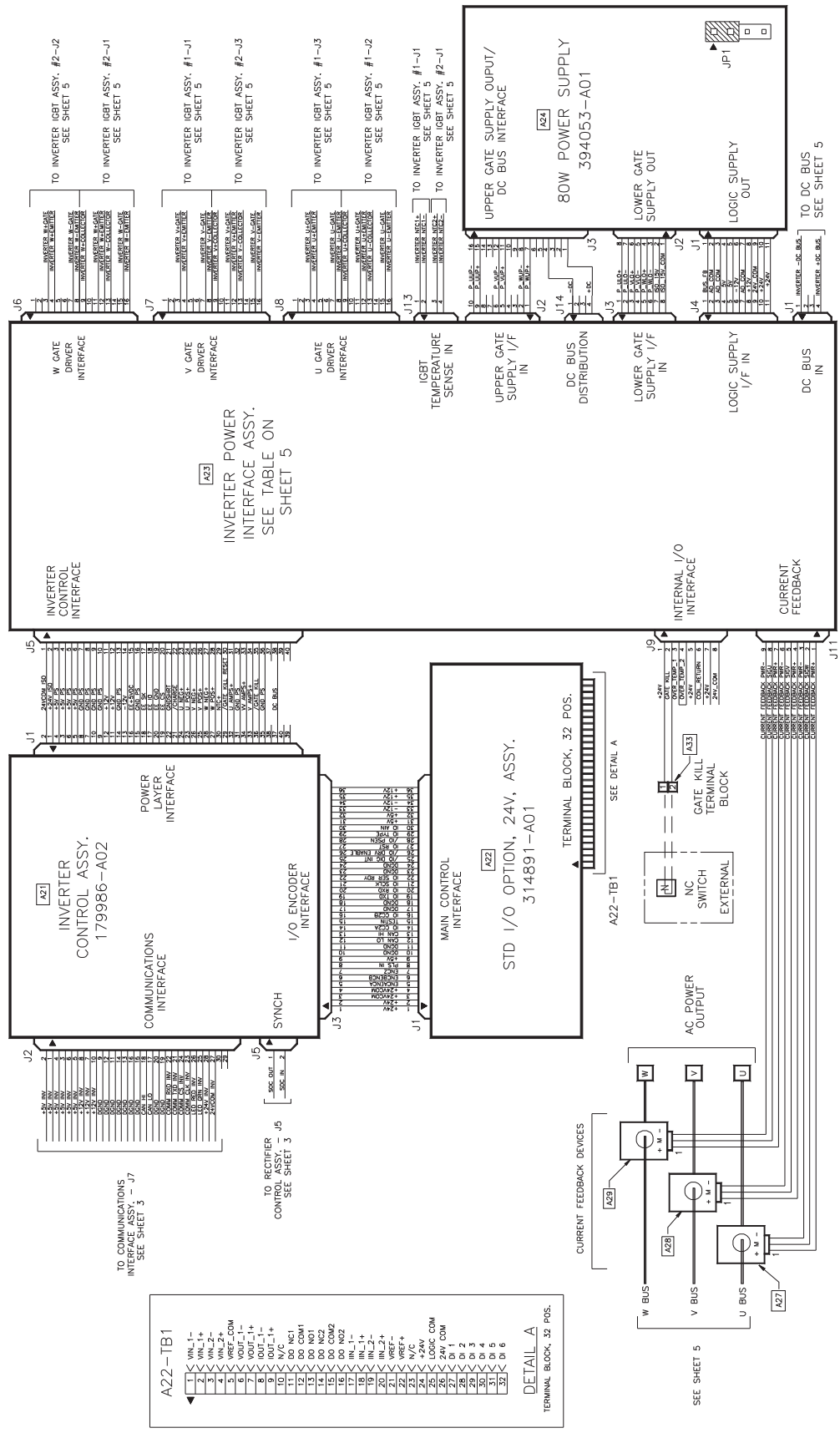
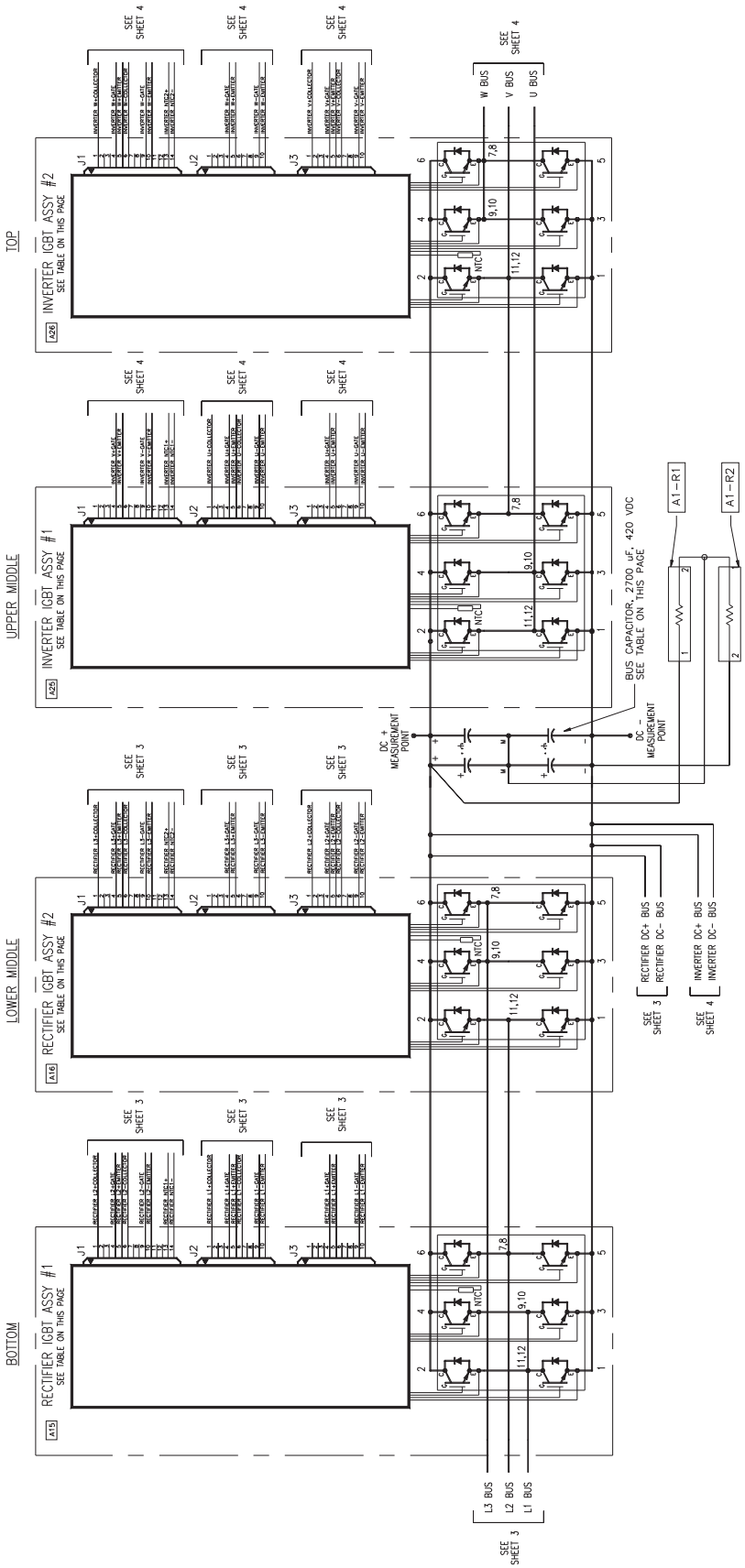


Figure 108 - Power Module IGBT Wiring Diagram (Frame 3 - sheet 5)



A1 VFD POWER MODULE TABLE

A1 FRAME	A1 MODEL NUMBER	ASSEMBLY NUMBER	A22	A34	A13	A15 A16	A23	A25 A26 BUS CAPACITOR QUANTITY	A25 A26 BUS CAPACITOR PART NUMBER
3AA	LF200460AAR	179521-A01	314891-A01	180037-A01	181725-A02	179527-A01	181725-A07	179527-A01 20	180139-Q02
	LF200405AAP	179734-A01	N.A.	N.A.	181725-A01		181725-A06		
3BA	LF200460BAR	179521-A02	314891-A01	180037-A01	181725-A03	179527-A02	181725-A07	179527-A01 24	180139-Q02
3BB	LF200520BBR	179521-A04	314891-A01	180037-A01	181725-A03	179527-A02	181725-A08	179527-A02 24	180139-Q02
3CC	LF200608CCR	179521-A03	314891-A01	180037-A01	181725-A04	179527-A02	181725-A10	179527-A02 24	184698
	LF200608CCP	179734-A02	N.A.	N.A.	181725-A05		181725-A09		

Notes:

LiquiFlo 2.0 Drive Frame 4 Wiring Diagrams

Frame 4 Wiring Diagrams

See the following pages for these LiquiFlo 2.0 Frame 4 wiring diagrams.

Figure 109, Drive Assembly Cabinet Wiring Diagram (Frame 4) on page 256

Figure 110, Power Module Wiring Diagram (Frame 4 - sheet 1) on page 257

Figure 111, Power Module Control Wiring Diagram (Frame 4 - sheet 2) on page 258

Figure 112, Power Module Inverter/Rectifier Wiring Diagram (Frame 4 - sheet 3) on page 259

Figure 113, Power Module Rectifier IGBT Wiring Diagram (Frame 4 - sheet 4) on page 260

Figure 114, Power Module Inverter IGBT Wiring Diagram (Frame 4 - sheet 5) on page 261

Figure 109 - Drive Assembly Cabinet Wiring Diagram (Frame 4)

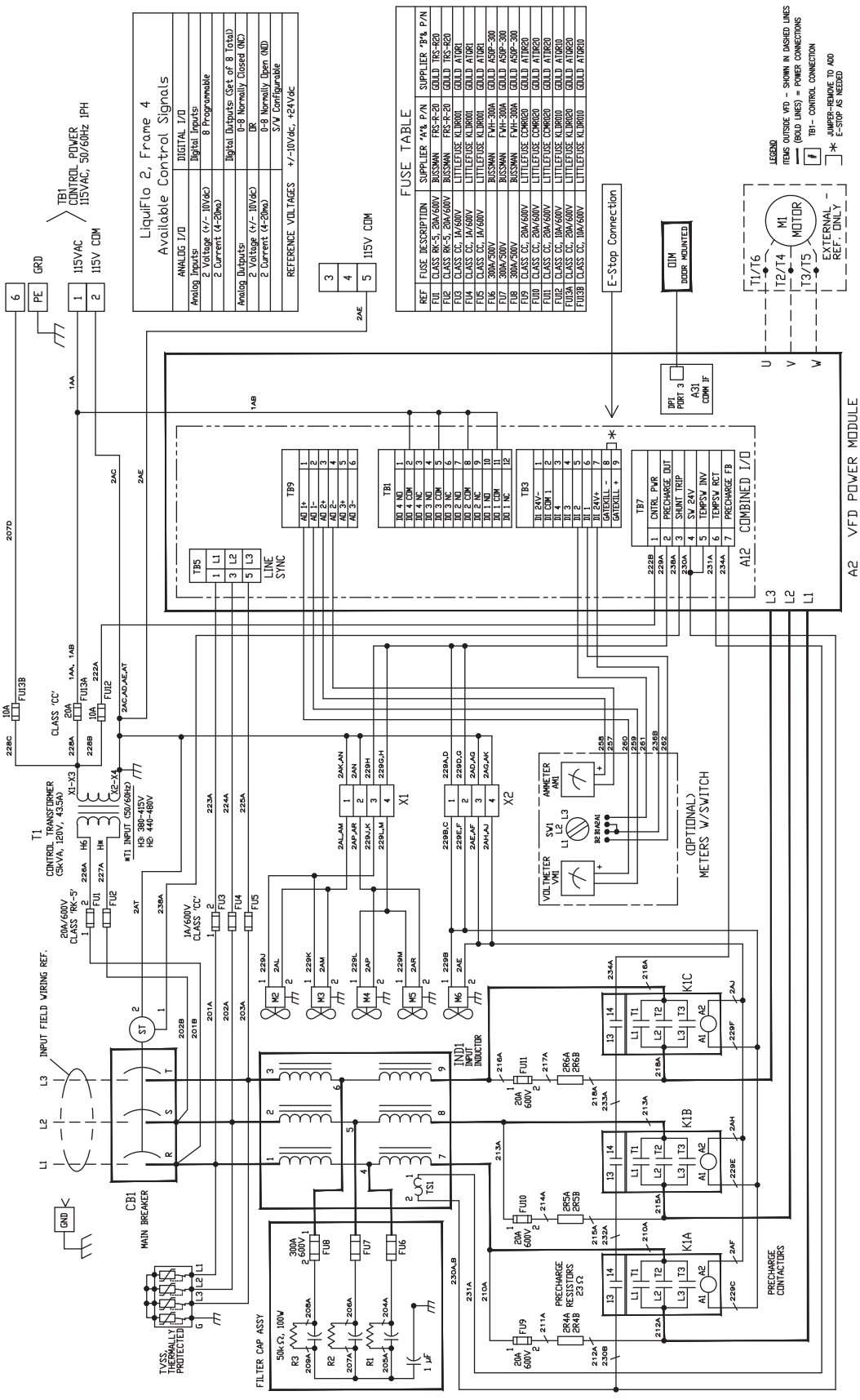


Figure 110 - Power Module Wiring Diagram (Frame 4 - sheet 1)

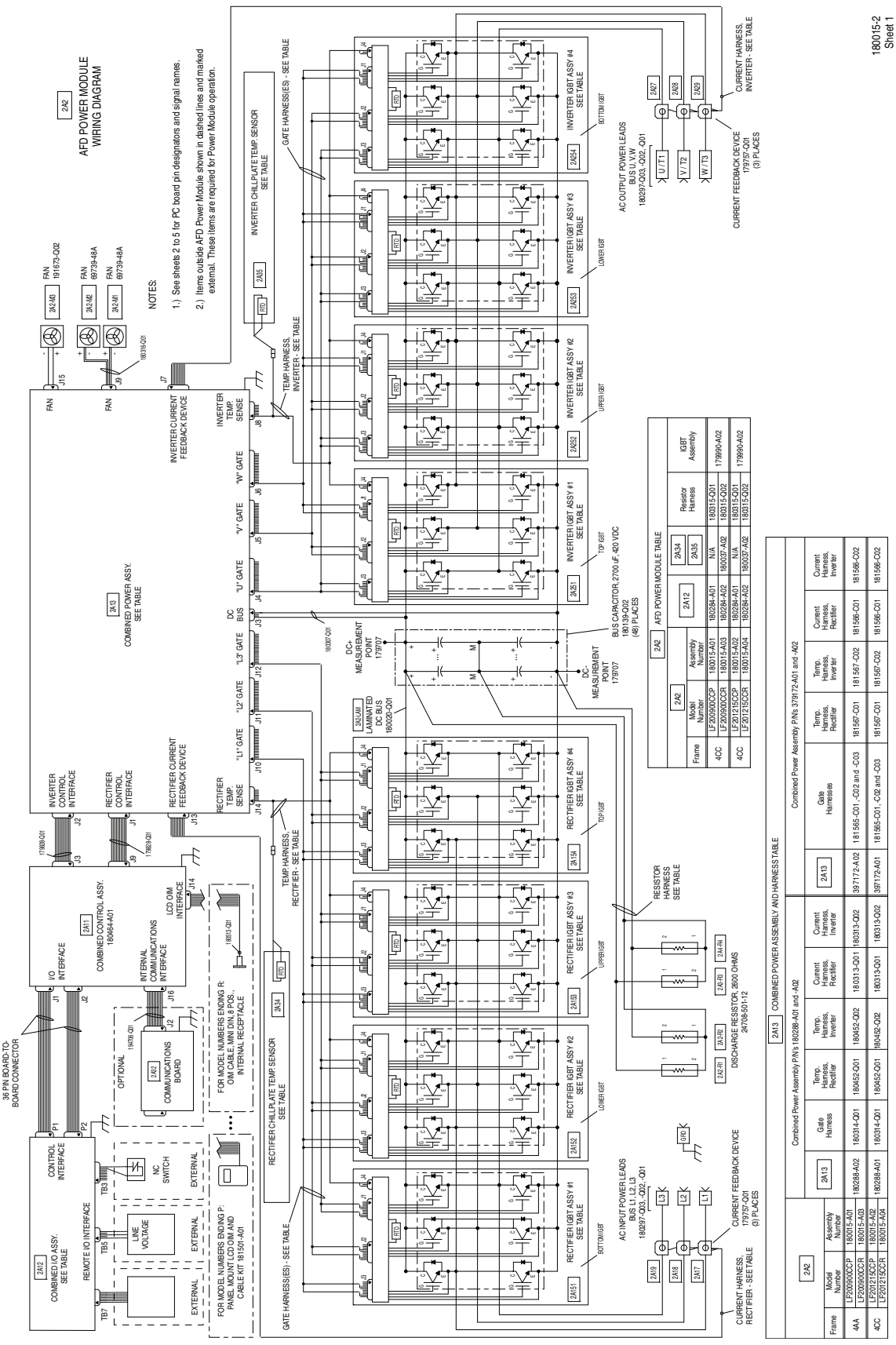


Figure 111 - Power Module Control Wiring Diagram (Frame 4 - sheet 2)

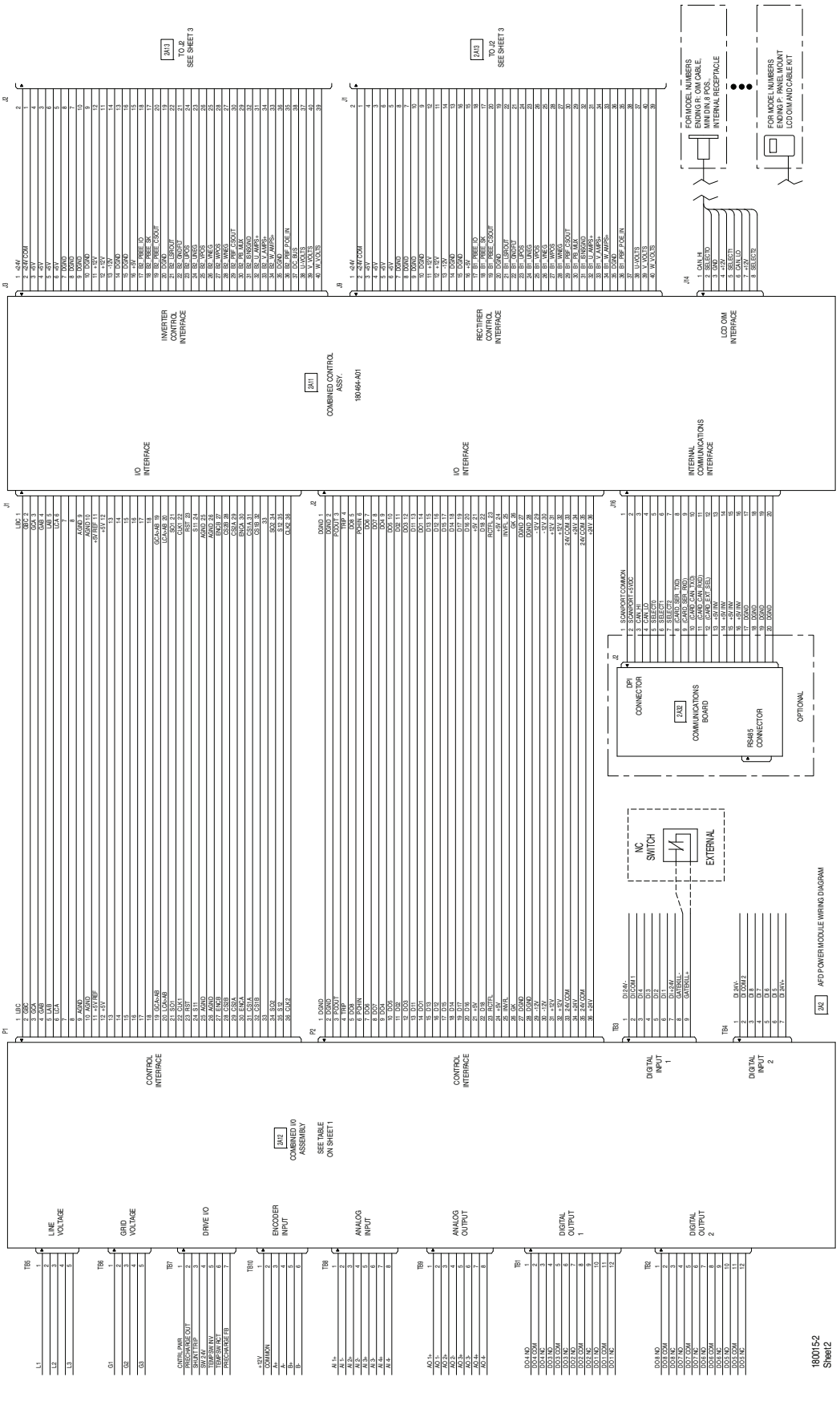


Figure 112 - Power Module Inverter/Rectifier Wiring Diagram (Frame 4 - sheet 3)

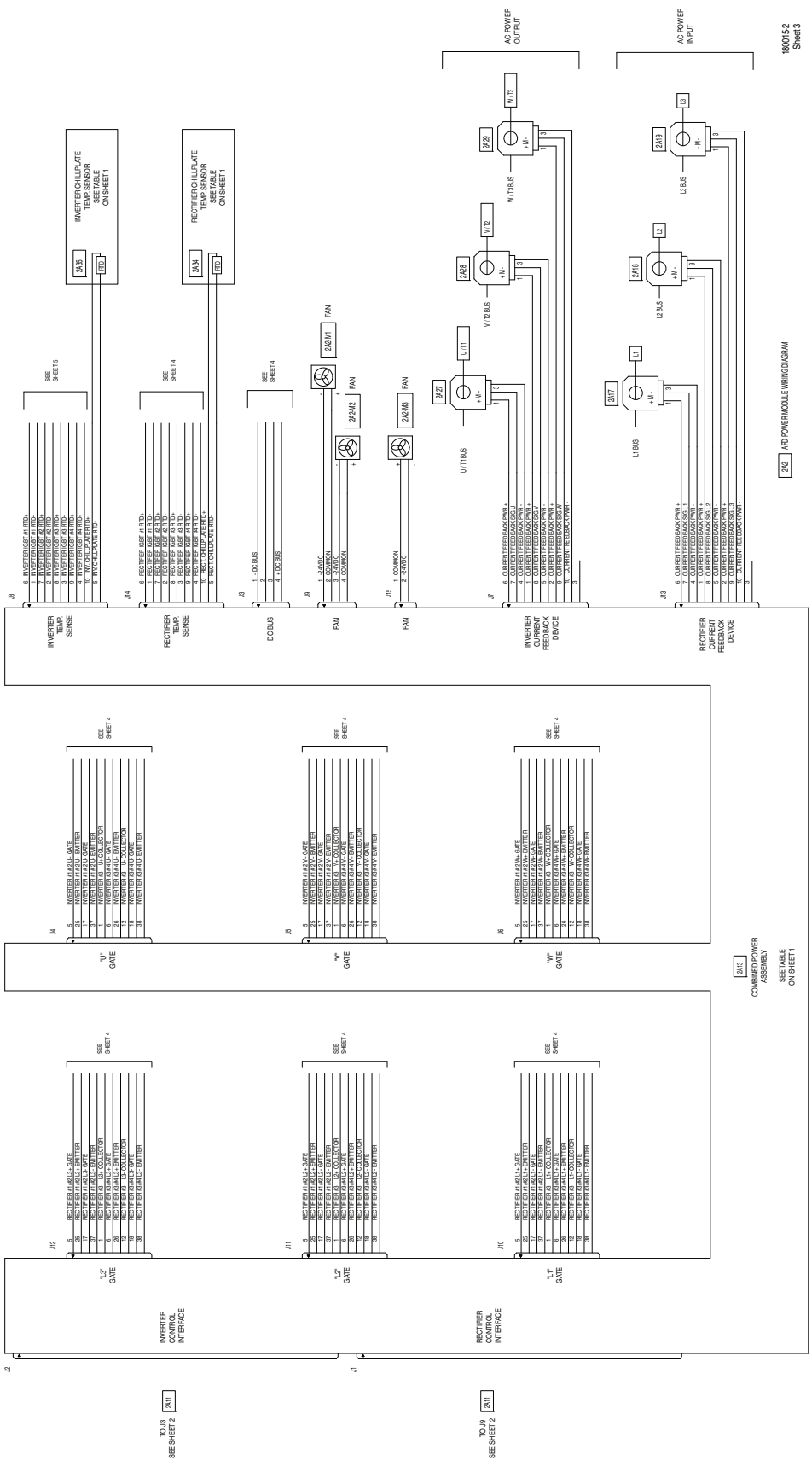


Figure 113 - Power Module Rectifier IGBT Wiring Diagram (Frame 4 - sheet 4)

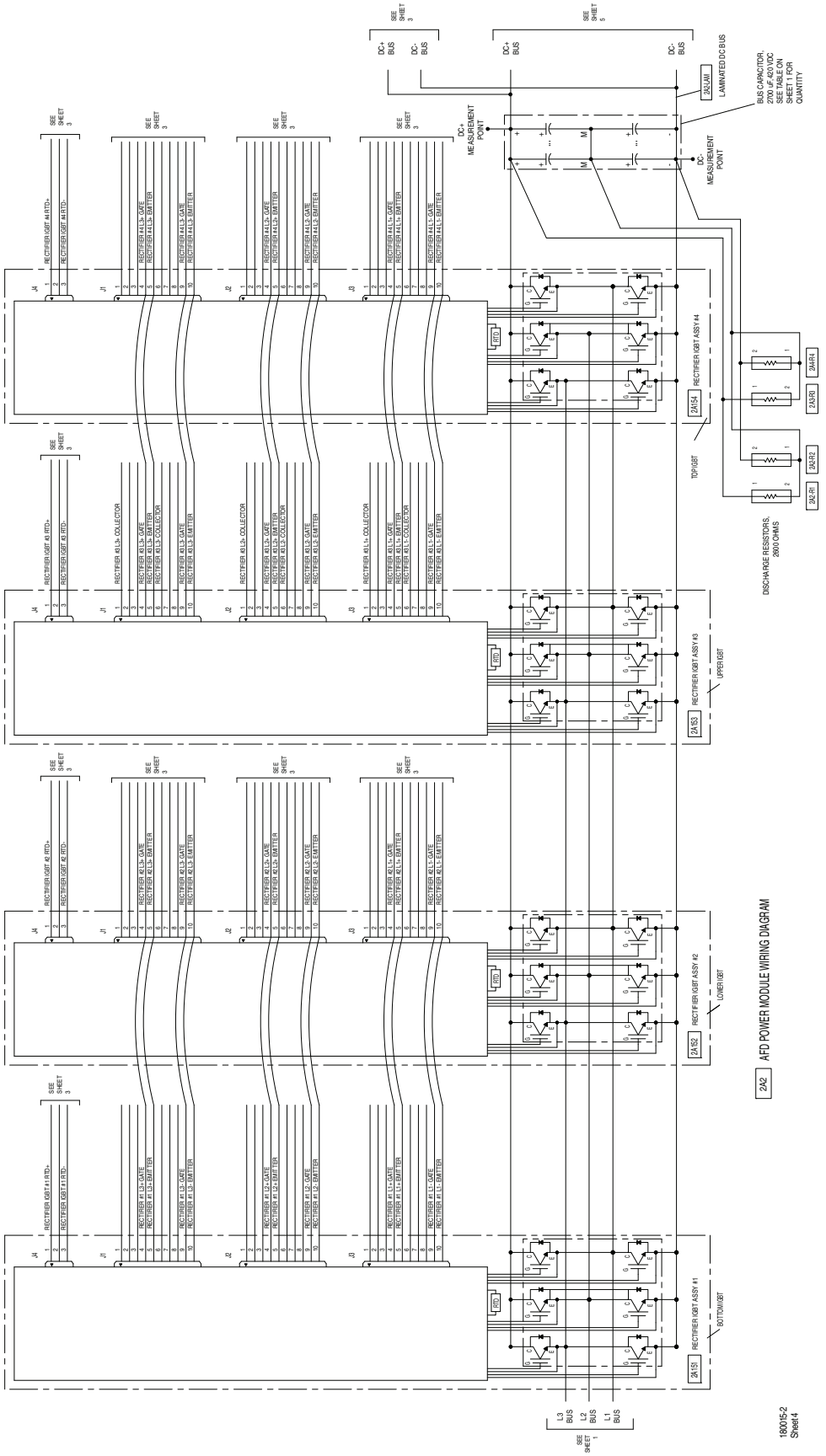
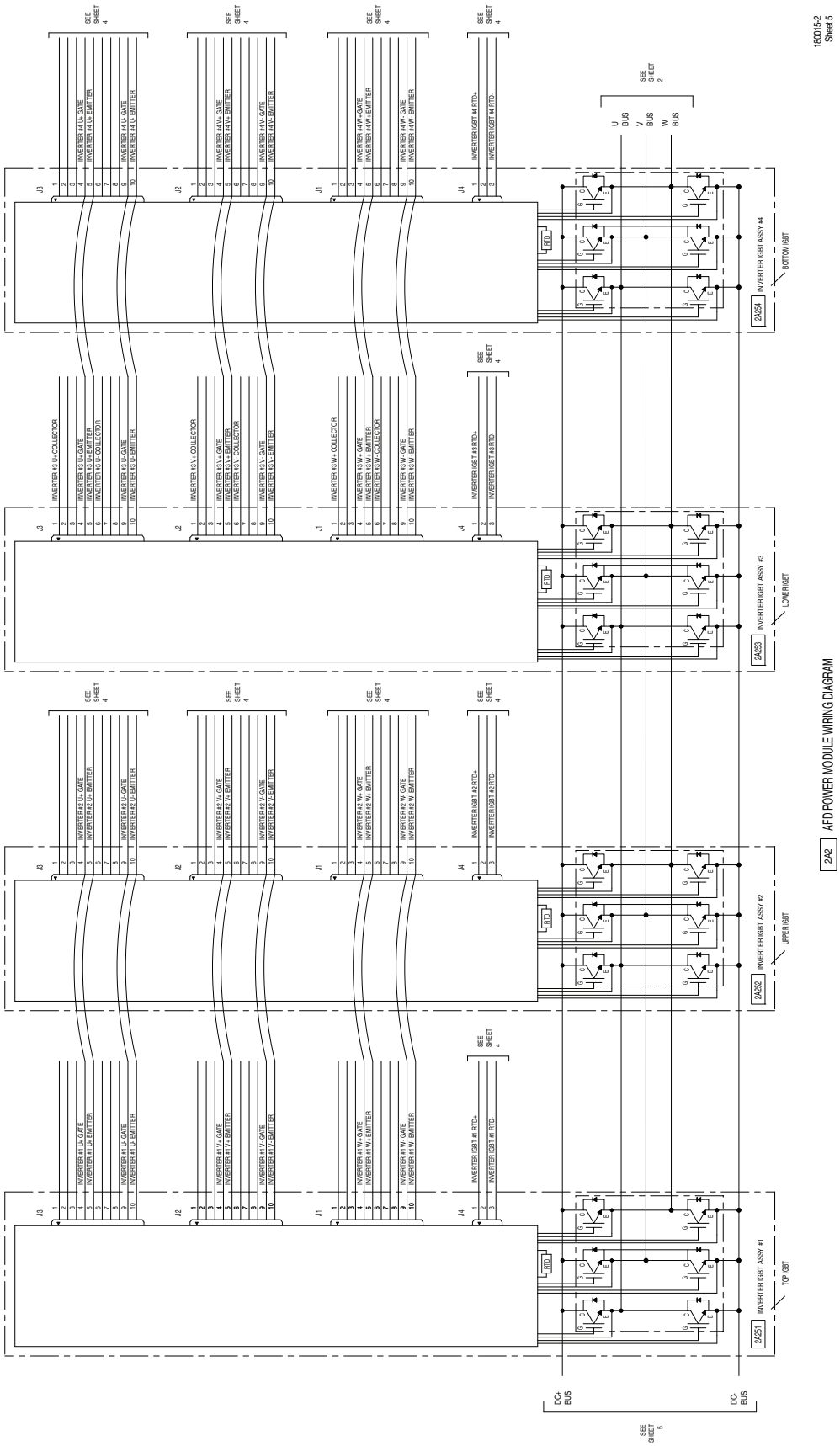


Figure 114 - Power Module Inverter IGBT Wiring Diagram (Frame 4 - sheet 5)



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